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International PROJECTIONIST

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January 1935
Vol. 8 No. 1

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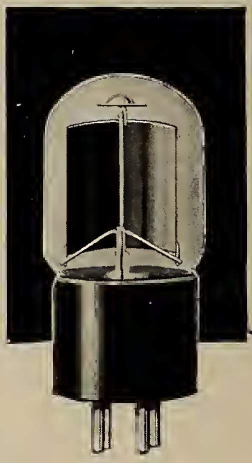

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 8 JANUARY 1935 *Number 1*

Index and Monthly Chat 5

Formidable Opposition Develops to Electrics' Servicing 7
JAMES J. FINN

Servicing Situation Highlights 8

Something for Nothing: How Much Will It Cost? 10
J. E. ROBIN

Projectionists Plan Service Battle 12

Modern Amplifiers Reflect Vast Improvement in the Art 13
LEROY W. CHADBOURNE

Notes on Loudness, Pitch 15
DR. HARVEY FLETCHER

Films, Radio & Television Assayed by Dr. Goldsmith 16

Studios Finally Move to Correct Varying Print Densities Evil 17

Effect of Aperture Lenses on Illumination 18
WILBUR B. RAYTON

The Editorial Page 21

New Vistas in Sound Transmission 22
LEOPOLD STOKOWSKI

News Notes 23

New Equipment 24

Projection Rises to New Heights in First Airplane Movie Show 26

News

Technical Hints

Miscellaneous Items

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420

MONTHLY CHAT

THANK you one and all for the nice reception accorded the last issue of I. P. Such close attention by and grand cooperation from the field cannot help but work out very well both for I. P. and its reader friends. Incidentally, can we help it if I. P.'s circulation has increased eleven per cent within the past two months, even as its advertising this month increased twenty-eight per cent?

IF THE electrics survive the cargo of poison gas unloosed in their direction upon disclosure of their "extended" servicing plans, projectionists will have only themselves to blame. The signing of a couple of circuits who happen to be heavily in debt to the electrics doesn't insure the success of the plan.

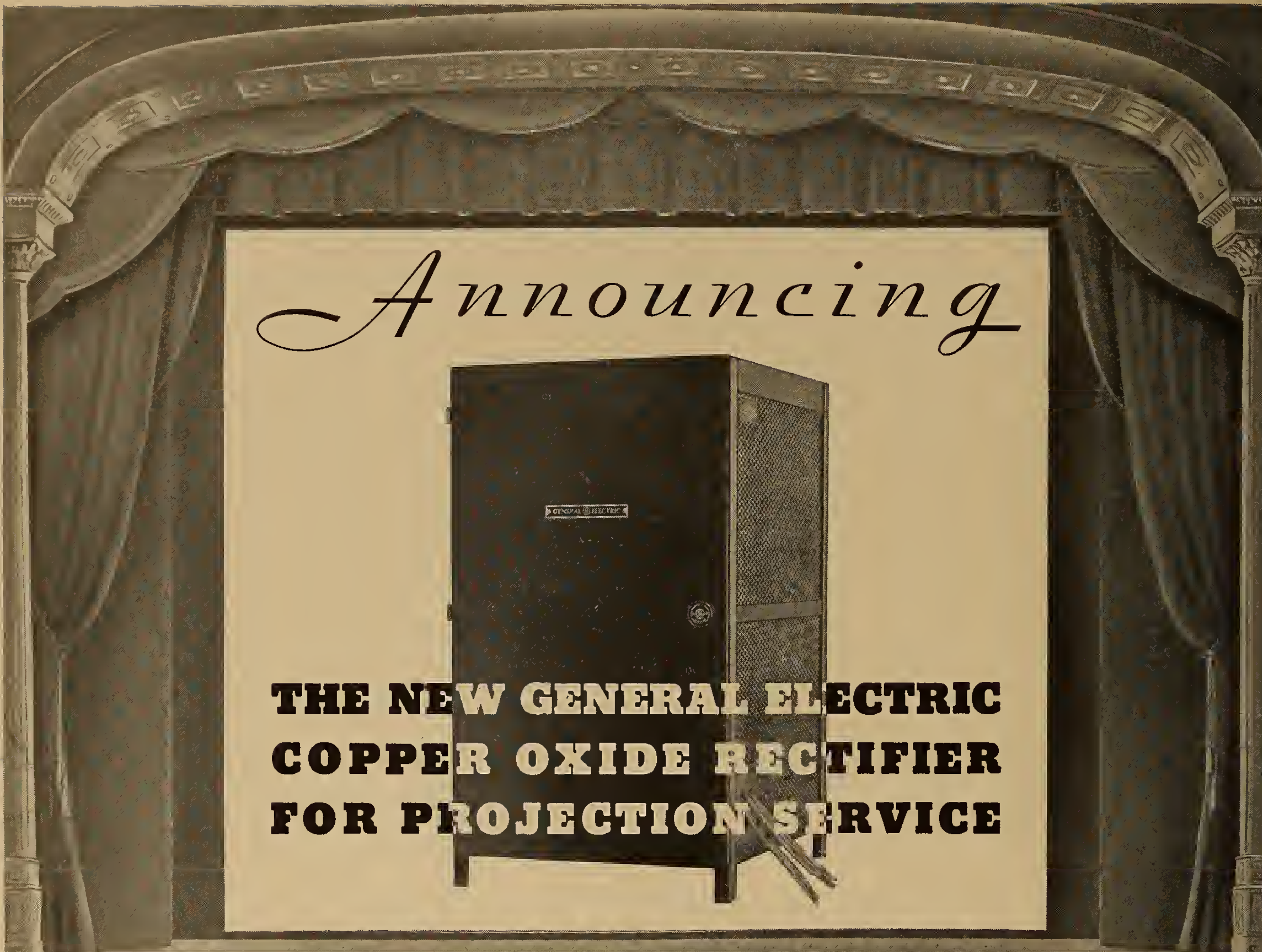
WHAT ever became of the grandiose plan to sell a million dollars worth of equipment to theatres through federal modernization loans? Probably those trade papers who "created" this fantastic tale will now explain why they ducked out of running follow-up stories. The story was pretty lousy anyhow, for it served only for one issue.

NEXT month will be handed down the U. S. Supreme Court decision on the Tri-Ergon mess. Should Mr. Bill Fox win out, projection rooms will witness feverish activity by the electrics to alter their heretofore well-advertised "patent-protected" sound equipments.

CONVERSION of existing low-intensity lamps for use with Suprex carbons has never appealed to us, except when the process was necessary to practically force the production of D. C. lamps in opposition to the A. C. junk then flooding the country. Now that D. C. Suprex operation is generally approved, and lamps therefor available, we can see no reason for continued use of converted lamps.

More than a year ago we counselled lamp manufacturers not to oppose conversion jobs, because the conversion job of early 1934 almost certainly meant a new lamp sometime in 1935. The soundness of this advice is now being demonstrated throughout the country. Why is a conversion job unsatisfactory? The detailed answer will appear herein next month. Manufacturers' orders for reprints filled in order of receipt.

DR. A. N. GOLDSMITH certainly slaughtered the television stock promotors during his recent Cleveland speech relative to new advances in the electronic art, a brief resume of which appears herein. Better still, a nationwide radio hook-up carried the good Doctor's message to a tremendous audience. Which is all to the good, in view of the current activity by television stock enthusiasts.



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INTERNATIONAL PROJECTIONIST

VOLUME VIII NUMBER 1

JANUARY 1935

Formidable Opposition Develops to Electrics' Servicing

Labor and Supply Dealers Lead Fight Against Extension of Electrics' Activities; Federal Probe Threatened

By *James J. Finn*

"MISLEADING, misinformed, misconception and mis-statement" are a few bits of language employed by the "electrics" in commenting on the exclusive announcement in the last issue of I. P. of the new all-inclusive servicing plan, covering the theatre from the roof to the cellar, sponsored by the electrics. Significantly, however, formal statements of denial were conspicuously lacking.

I. P.'s exclusive story was picked up by the entire industry trade press, several of whom conveniently forgot to observe the copyright notice, not to mention the conventional amenities of such situations.

In the interim there has developed formidable opposition to the new servicing plan of the electrics, with dealers, manufacturers, exhibitors and Labor joining forces to resist its introduction on a general scale. Particularly embittered, and very active in marshalling opposition to the plan, were supply dealers, whose attitude is perhaps best expressed in an article by J. E. Robin, president of the Independent Theatre Supply Dealers Assoc., appearing elsewhere in this issue.

Mr. Robin bluntly states that, failing to protect their interests by ordinary means, his members will carry the fight directly to the Government and insist upon a sweeping investigation of the activities of the electrics in the motion picture field. Robin also reveals Association plans for the establishment of a testing laboratory for all theatre equipment. He claims, further, that a chain servicing organization can never hope to render the same extensive quality service as can a local supply dealer.

Far less voluble than the supply dealers, but just as unrelenting and active behind the scenes in its opposition to the electrics' servicing plan, was the I.A.T.S.E., parent body of more than 25,000 projectionist and stagehand members now working in theatres throughout the U. S. and in Canada.

Following a meeting of the General Executive Board of the Alliance, devoted entirely to discussion of the danger

threatening its members through operation of the electrics' servicing plan, INTERNATIONAL PROJECTIONIST obtained exclusively the following statement relative to the official stand of the Alliance on the matter:

"The General Executive Board of the International Alliance has thoroughly investigated the projected general theatre servicing plan. The Alliance will insist, without qualification, that this work be maintained by the members of its Local organizations, and that the jurisdictional rights of the Alliance be fully protected. There will be no deviation from this policy nationally or locally.

"Intensive work looking toward the maintenance of I. A. rights is now proceeding, upon the completion of which the I. A. will instruct its affiliated Local Unions."

Opposition to the plan from Labor was entirely unexpected by the electrics, and it is likely that their program will be disrupted badly as a result thereof.

No longer is it a secret, of course, that the General Office of the I. A. has been aware of the electrics' intention for some months past and has, in fact, done intensive investigational work in various sections of the country in an effort to uncover the true picture of the electrics' activities, some of the information appearing this month and last in these columns being culled from this source.

Attending the session of the General Executive Board which considered the servicing problem was James J. Finn, editor of INTERNATIONAL PROJECTIONIST, who outlined his views on the matter and advocated strenuous opposition to the electrics' plans, plus the participation by I. A. men throughout the country in servicing work of every description.

Loew's Drops Erpi Service

Erpi sustained another hard blow during the month when Loew's Theatres, Inc., dispensed with Erpi service in 63 Loew theatres in the Metropolitan New York area and barred Erpi service engineers from the houses. Announcement of policy with respect to the other 72 Loew theatres throughout the country is expected shortly, and it appears certain that Erpi will lose these accounts also.

Loew is the latest major exhibition company to adopt this course, Warner theatres having discontinued Erpi service in all its theatres on January 1 last. Significantly, the move implies no obligation on the part of either Warner or Loew to purchase only Erpi replacement parts and accessories.

It became known that, subsequent to publication of the last issue of I. P., Erpi gave "verbal assurances" to I. A. officials that their "extended servicing" plan had been misrepresented in the press and that its operation would not encroach in any way upon the jurisdiction of I. A. members working in theatres. Upon learning of this happening, INTERNATIONAL PROJECTIONIST sought to have a responsible official of Erpi reduce this view to a formal written statement. The statement was not forthcoming, being turned aside with the answer that "Erpi has nothing to say about the servicing plan at present."

Meanwhile, even while giving "verbal assurances" of non-encroachment on projectionists' work, Erpi continued to manifest a keen interest in projection equipment and technique. I. P. learned from a very reliable source that Erpi purchased recently in New York City 20 new projector heads, possibly for their laboratory, cited in these columns last month as containing every conceivable type of projection equipment: lamps, arcs, carbons, generators, rectifiers, lenses, condensers, screens, expensive illuminometers and other equipment.

I. P. has a complete list of all equipment in one such shop.

Not to mention the fact, of course, that Erpi is recorded as having purchased two complete sets of projector repair tools. Erpi's investment in projection equipment, surveys and general preparation to date is conservatively estimated as exceeding $25,000.

The offices of I. P. were deluged with requests from projectionist organizations and individuals relating to the electrics' all-embracing servicing plan, as well as with inquiries as to how best projectionists could move to resist this latest threat to their security. I. P. is servicing these correspondents as fast as its facilities permit. Detailed reference to this phase of the situation is appended to this article.

RCA's Position

The attitude of RCA Manufacturing Co., makers of RCA Photophone sound equipment, toward the reception accorded the all-inclusive servicing plan by the field was in marked favorable contrast to the typical policy of silence adhered to by Erpi. A representative of RCA in the course of a two-hour session with this writer informally summed up the RCA stand as follows:

1. RCA contemplates an "extended servicing" plan, but—

2. It would be launched solely as a "goodwill" maker in the exhibition field and *without additional cost* to those theatres now using RCA service; and

3. The RCA plan positively would not conflict with the interests of either projectionists or stagehands, or any other crafts, and, in fact, RCA would scrupulously avoid even an appearance of conflict; also

4. RCA does not now and will not

(Continued on second page following)

Servicing Situation Highlights

Erpi's Stand

"We have no statement anent servicing plans to make at this time," said Erpi representative in typical fashion of avoiding enlightening comment and forcing the industry press to print the "misleading and misinformed" information which Erpi subsequently criticizes.

RCA's Stand

RCA in a frank, straightforward statement admits plans for "extended servicing" and outlines its position with respect to charges, equipment sales, and policy with respect to Labor's rights.

Loew Drops Erpi Service

The 63 Loew theatres in Metropolitan New York territory drop Erpi sound service. Loew policy with respect to 72 theatres elsewhere in country to be announced shortly. Likely will also drop Erpi service. Warner Theatres dropped Erpi service on January 1 last.

I. A. T. S. E. Stand

The International Alliance announces "unqalified opposition" to any general theatre servicing plan which will threaten even remotely the jurisdictional rights of its members. Advocates handling of service, for projection and sound equipment, by affiliated Local Unions. Is now formulating policy which will govern its activities on a national scale, to be announced shortly.

Theatre Supply Dealers

Theatre supply dealers band together to resist electrics' servicing plans. J. E. Robin, president of independent dealers, threatens a Federal investigation of sound company activities in motion picture field. He also derides electrics' statements that service will be free and used solely to build goodwill.

Erpi's Projection Interest

Reliable reports of recent purchase by Erpi of 20 new projector heads in New York area; plus another purchase of two complete sets of projector repair tools. Laboratory housing every conceivable type of projection equipment continues to operate and acquire more equipment.

Countrywide Opposition

Projectionist organizations move quickly to offer service to theatres either free or for small charge which electrics could not possibly match. Service to include both projection and sound equipment.

40-65 Ampere D. C.
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HIGH Intensity D. C. projection is now available at currents below those used by Hi-Lo projection lamps and the High Intensity Condenser type. Special lamps have been designed and placed on the market to use National SUPREX Carbons, developed by National Carbon Company Research Laboratories.

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in the future sell any equipment that it does not itself make in its own plant, and

5. Since its servicing plan is based entirely upon its worth as a goodwill builder, extensive opposition to the plan within the field likely would mean that RCA would abandon the plan rather than have it operate to defeat the very purpose behind its introduction; and

6. RCA would readily give positive assurance on any or all of the aforementioned points.

Citing a paragraph in these columns last month, as follows:

"If, on the other hand, such a servicing plan will not operate to encroach further upon the projectionist's domain . . . and if it will help the projectionist to produce a better show through keeping his equipment up to snuff by obtaining parts and effecting needed repairs—then, *and only then,* the plan might be acceptable to Labor,"

RCA holds that its plan would certainly write an affirmative answer to the foregoing ifs.

Erpi maintained a discreet silence on its intentions, as stated previously, evidently thinking the situation not important enough to warrant a statement or being too busy furthering its servicing plans.

Thus it is impossible for the electrics to deny any longer that they contemplate "extended servicing" plans. I. P.'s disclosures smoked out this fact, at any rate. In fact, *Motion Picture Daily* not only confirmed Erpi's servicing intentions but actually printed a list of names of those who will supervise such activities in various territories.

With their plans uncovered and further denial of intentions being quite futile, there now remains to be answered only the question as to just how far the electrics' activities in this direction will lead.

Possible Federal Action

Should the supply dealers carry through on their threat to force a Federal investigation of the electrics' activities in the motion picture field, interesting possibilities loom up on the horizon, particularly in view of the fact that hearings on pending communications legislation, in which A. T. & T., Erpi parent body, will be subjected to the glare of the publicity spotlight, will be begun in Washington early in February. A rumpus in the picture field, in which an A. T. & T. subsidiary was involved, might affect adversely the communications interests of A. T. & T.

It is no secret, of course, that supply dealers throughout the country are lining up support for their cause and urging that pressure be put on Washington legislators to the end that the communications investigation be supplied with ample funds and backed to the limit. This is only one phase of the dealers' attack on the general servicing plan. If, on top of this, Labor should utter a few deep-throated and well-directed growls at the psychological moment, the electrics might find themselves in pretty deep water, speaking in terms of public relations.

International Projectionist is advocating intense resistance by Labor, supply dealers, manufacturers and others to any extension of theatre servicing by the electrics. In fact, this publication is not content that the opposition confine itself merely to resisting an "extension" of electrics' servicing, but is backing the plan of projectionists taking over the servicing not only of projection equipment but of sound systems as well.

With a large majority of electrics' contracts now expiring, or already expired, I. P. advances the thought that there will never exist a better time than the present for projectionists to move in and displace the sound system engineers. This publication holds that this new servicing plan is merely the

SOMETHING FOR NOTHING: HOW MUCH WILL IT COST?

J. E. Robin

PRESIDENT, INDEPENDENT THEATRE SUPPLY DEALERS ASSOCIATION

IN THE December issue of this publication, James J. Finn analyzed the projected super-servicing plans of the "electrics" and pointed out clearly that projectionists and stagehands could not but be unfavorably affected by this development. Mr. Finn could not, of course, dwell at great length on the position of the dealers and the manufacturers in this dangerous situation. It is, therefore, a privilege to accept his invitation to state the case of these two groups, particularly the first-named.

We have been reliably informed that the "electrics" intend to furnish this remarkable service at no cost to the exhibitors and purely for the purpose of developing "goodwill." This is really too good to be true and makes us wonder whether the millenium has arrived.

We would not think of intimating that this magnanimous and well-meaning cooperation is inspired by any ulterior motive. But history has a way of repeating itself, and our memory of what happened with regard to sound apparatus somehow makes us feel that the super-servicing plan is only the first step in the wrong direction, that is, as far as dealers, manufacturers, exhibitors and Labor are concerned.

Manufacturers' Stand

Now, will the manufacturers jump at an opportunity to sell to the "electrics" quantities of equipment that will no doubt exceed those that the independent dealers could absorb? Of course, they will; but we maintain that they would eventually regret the adoption of such a policy. Again, experience supplys us with the answer. It will be but a short while before the "electrics" will be turning out all the various forms of equipment that their servicing will require. Logically, what is the next step?

It requires no great amount of intelligence and imagination to paint the picture. It is unavoidable that the exhibitors who have been the recipients of this "free" and all-embracing service will show their deep appreciation by following the "recommendations" of the "electrics'" experts and purchase from the latter the parts and equipment which they may (or may not) need. This will leave the manufacturers out in the cold without even the possibility of turning to the independent dealers who, by that time, will have been entirely squeezed out of the picture.

It is a well-known fact that RCA and ERPI have for some time past been selling complete projection and sound equipments for industrial use, schools and others which may be classed as the non-theatrical field. In many instances, the projection equipment, with the exception of the sound apparatus and screens, has been procured from a dealer, and on almost all jobs the sale has been made by the "electrics" and billed by them.

The RCA Radiotron Co., Inc., tube manufacturers and a unit of the RCA Manufacturing Co., are so concerned with the welfare of the independent theatre supply dealers that they have been selling Radiotron tubes at list less 40% to theatre owners who have signed a contract covering their tube requirements for one year. The distributors, who have an overhead and a payroll to meet, cannot in many instances buy these tubes for resale on a competitive basis.

Eliminate Service Charges

If the "electrics" are so interested in building up "goodwill" that they are desirous of rendering a *free* consulting service in addition to the regular inspection and maintenance service agreement that they have, it occurs to us, as businessmen, that they could do this much more expeditiously and effectively by eliminating the service charge on

(*Continued on page* 34)

Still UNIQUE

WHEN it was introduced in 1931, Eastman Super-Sensitive Panchromatic Negative was definitely a "new and different" product. And there is still no other film like it...no other has wrought comparable changes in motion picture procedure, or contributed as much to motion picture quality. It is only natural that this Eastman film should be unique, also, in the enthusiasm which it continues to arouse among cameramen and producers. Eastman Kodak Company. (J. E. Brulatour, Inc., Distributors, New York, Chicago, Hollywood.)

EASTMAN *Super-Sensitive Panchromatic Negative*

last-ditch fight of the electrics to retain their identity as a theatre servicing organization, with its (to date) lucrative pickings—straight equipment sales of sound equipment today being mostly replacement jobs.

Sink-or-Swim Situation

Further, I. P. points out, now is the time for direct action by projectionists and others on a basis of sink-or-swim —the sinking to happen if the electrics are permitted to write thousands of contracts now for an indefinite number of years. Either projectionists get out now and take control of matters, is the view of I. P., as they should have done in 1927-28, or forever be relegated to a position of secondary importance in the theatre field.

An encouraging feature of the mass of letters received by I. P. from projectionist organizations throughout the country, relative to the servicing situation, is the widespread mention of the need for more activity along technical lines by the organized projectionist, either through some national technical organization or direct from the General Office of the I. A. Previous efforts to form and maintain some such organization have been made, dating back to 1928, but the need for such cooperation evidently was not acute at that time and the then existing societies and groups were allowed to languish.

Announcement that several I. A. units are already engaged in general theatre servicing work, including sound systems, came as a surprise to a majority of Local Unions. Only Cleveland and San Francisco have been cited in previous articles herein, yet there are at least ten other cities where Local Unions are engaged in servicing work.

Cleveland's theatre servicing work by projectionists dates back to silent picture days, thus it is not new, the Local there incorporating the service, which is free, into its contract for Labor. Equipment breakdowns are reported direct to an office maintained by the Union, several members of which are always on call. A small truck, capable of carrying all necessary equipment, is used, and spare heads, jaws, lamps, lenses, batteries—in fact, all necessary equipment—is included.

Cleveland theatres would never think of calling anybody but the Union man in the case of a breakdown or any trouble, whether in the sound or the projection equipment.

San Francisco's service work started at the time the original RCA servicing contracts expired. At the invitation of RCA, Local 162 agreed to assume the servicing of several theatres. The RCA service engineer, who happened to be a member of an eastern Local, was taken over by the Local. Expecting to suffer a loss on this service man, Local 162 was agreeably surprised after two years of service work to find that his operations had netted a small profit—even after the expenditure of $500 for a test set and proper servicing tools and equipment.

New theatres were continually added to the Local's service roll, with the small independent exhibitor welcoming the opportunity to get immediate sound service at a cost of one-third what he formerly paid to the electrics. Local 162 did not enter upon servicing work to make money, or even to gain manpower, its attitude being that such action was the very best insurance in the world against any encroachment upon its jurisdiction.

Several interesting angles present themselves relative to such servicing activities by Local Unions:

1. Should the service be free, or should there be a charge made for the costs involved, wages, equipment and upkeep? The answer to this question naturally depends upon prevailing conditions in the various localities.

Obviously, the electrics cannot afford to render service without cost; but the Local Union can, charging the cost to job-insurance, or security-insurance. But should the service be free? It appears that such Locals as are now rendering service have no trouble at all in getting paid for it, the price always being kept below the lowest level possible for the electrics to establish. Such income will go toward paying the cost of Local servicing operation, and might even net a small profit, to which no exhibitor would object provided his costs were being sharply cut below the electrics' figures.

2. The angle of existing servicing contracts should be carefully investigated before a Local assumes servicing of a given theatre. This is important.

3. Competency is a vital consideration. The work rendered by the Local should be on a par, from the standpoint of quality and promptness, with that rendered by the electrics. While important, this shouldn't prove too hard a nut to crack, since Local service men would not be interested in "forcing" the sale of equipment and parts.

4. The necessity for proper test equipment. The very same equipment now used by the electrics' service engineers, about which there is no mystery and which is easily obtainable in the open market, could be utilized by the Local. In fact, the S. M. P. E. visual and sound test reel, prepared by projection men within the Society, is now utilized by the electrics and is available to anybody who wants it. In addition, the Local service man would have the advantage of complete cooperation on the part of the projectionists, from his own organization, working in the theatre.

Projectionists Plan Service Battle

INDICATIVE of the attitude of projectionist organizations throughout the country on any extension of servicing activities by the electrics, and reflecting the influence of I. P. in spurring projectionists to action, is the following letter which is representative of a mass of letters anent this topic received by I. P.:

Editor, I. P.

Sir: I am planning a meeting of several projectionist groups for next Sunday to consider this whole proposition of projection and sound equipment servicing. I am sure that you can be of great help in supplying data and advice as to the best procedure for us to follow.

I am reluctant to ask so much from you, but then that is what you get for being so "doggone" efficient and getting the dope before anybody else.

As I see it, projectionists have been snoozing for too long and have slipped a good bet by not taking a servicing proposition to the managers long before now. I believe that there is yet time to get down to business and put this thing over for ourselves.

Like all other sections of the country we drifted along from day to day, with some of the men applying themselves diligently and others just sitting back and letting the parade of progress pass them by. Now is the time for concerted action throughout the country, unless we all want to sink together and let others step into our places. The good men within our ranks will just have to exert themselves and pull the others to safety. If given the chance I think that our men can show the managers just as good, if not better, work than other service groups.

Now is just the time when we could use a strictly technical organization of projectionists, the value of which when they were functioning the men seemed strangely unable to appreciate. Right now is when we would be collecting royalties in profusion through the existence of such a body. Couldn't you apply your fine talents to reviving such a plan?

In closing, I think that projectionists have finally bestirred themselves into action, and you are the guy who supplied the spark to explode the bomb under them.

Charles E. Curle
Secretary, Local 259,
Chattanooga, Tenn.

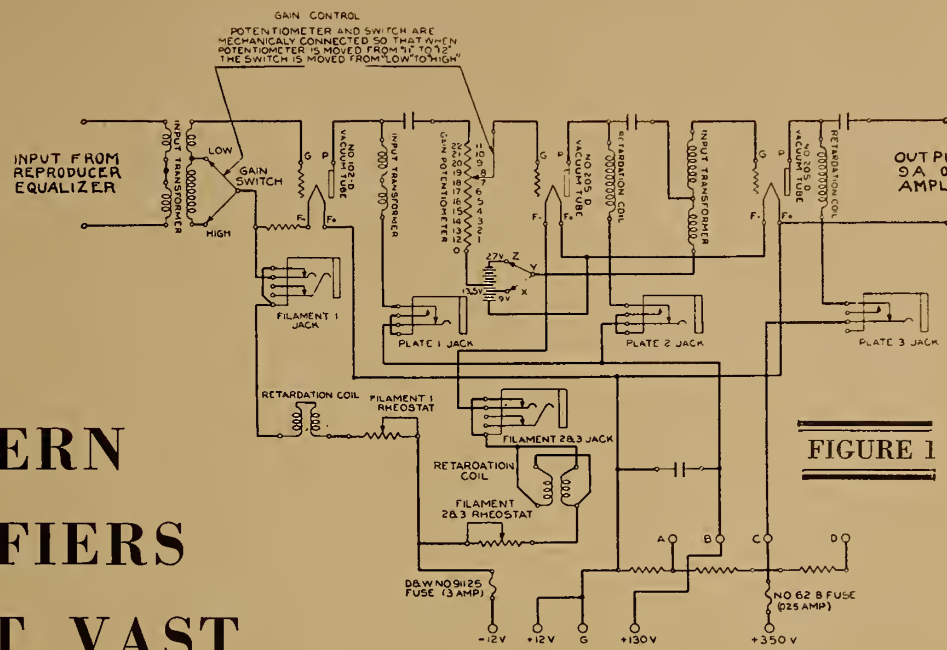


FIGURE 1

MODERN AMPLIFIERS REFLECT VAST IMPROVEMENT IN THE ART

Leroy W. Chadbourne

THE full extent of the changes that have taken place in the design of theatre amplifiers during the last few years cannot be appreciated until the old and new are placed side by side, as in Figures 1 and 2. Only by carrying the comparison down to small details can the projectionist realize what these changes mean to his work and to the nature of his responsibility.

Figure 1 represents one of the very first amplifiers used for theatre sound. Some of these amplifiers are giving satisfactory service even today in large de-luxe theatres.

The filament circuits of this amplifier begin at the bottom center of the drawing, with two terminals marked "—12V" and "+12V". The line from the positive terminal runs up, right, up, right, up an inch, right an inch and up an inch to the positive terminal of the filament of the extreme right-hand tube. Through this filament, then down, left and up to the filament of the center tube. Through this and down, left, down and right to "Filament 2 & 3 Jack", which is an arrangement for plugging an ammeter in series with the filament circuit to read the filament current.

From this jack to the double winding of the retardation coil. Thence down and left to "Filament 2 & 3 Rheostat." Thence to the negative terminal at the bottom of the drawing, through a three-ampere fuse.

This filament circuit has a branch line that supplies the extreme left-hand tube. From the positive terminal up, right, up, right, up an inch and then, instead of turning right, follow the other branch left about two inches, thence up an inch to the positive side of the filament. Through the filament, left through the grid bias resistor, and down to "Filament 1 Jack". Through this, through the retardation coil, through "Filament 1 Rheostat", and then down and right to the 3-ampere fuse and negative.

The source of power for this circuit is external, and consists of 12-volt storage batteries, although at present it is common practice to use a rectifier.

The source of plate power originates, as far as this amplifier is concerned, with the other three terminals at the bottom of the drawing, marked "G", "+130V." and "+350V." Beginning at the high voltage end, the line may be traced upward through the quarter-ampere fuse to "Plate 3 Jack", thence through the retardation coil to the plate of the right-hand tube. From the filament of that tube back to the positive terminal of the

NOTE: The drawings in this article are intended only to aid the reader in contrasting new and old amplifiers, and in no wise are they indicative of the present relative merits of various sound equipments.—Editor.

filament circuit, which is shorted to "G".

The 130-volt line for the other two tubes has two branches. From the 130-volt terminal up, right, up, right and up past the filter condenser, then left, and up to "Plate 2 Jack". Thence up through the retardation coil to the plate of the middle tube, and back to "G" through the filament circuit.

Instead of turning upward at "Plate 2 Jack" the other branch of this line may be traced leftward from the junction point below that jack and into "Plate 1 Jack". Thence upward through the coil marked "Input Transformer" to the plate of the left-hand tube.

In the lower right-hand corner of the drawing, just above the plate power input terminals are four terminal posts, "A", "B", "C", and "D". Just below these are three resistors. This arrangement is included to provide for a second type of plate power input.

The plate power for this amplifier was provided in two different ways. One was to use a 350-volt bank of glass-case storage "B" batteries. In that case the full 144 cells were connected to the "+350V" tap, and a branch connection was taken at the sixtieth cell for the "+130V" tap.

In other installations, plate power was derived from a vacuum-tube rectifier mounted on the amplifier rack alongside of Figure 1. In that case the "+130V" and "+350V" terminals were not used. Two wires, + and — 350 volts d.c. led from the rectifier. The negative line

was connected to "G" and the positive wire to "D". Jumpers were then added to connect "D" to "C", and "B" to "A". The three resistors then constituted a voltage divider bridging the plate line, and the drop through the two right-hand resistors reduced the voltage to 130 at the point where "A" connects.

The grid bias of the right-hand tube is secured as follows: From the negative leg of the filament down, left, down and left to the positive terminal of the 27-volt "C" battery. This consisted of a bank of flashlight type dry-cells fitting into a battery box that mounted on the front panel of the amplifier. From the top or negative terminal of that battery right through "Z" and "Y", and upward through the coil marked "Input Transformer" to the grid of the tube. The bias of this grid was then 27 volts *plus* half the drop through its filament—that is, it was while the batteries remained fresh.

The bias of the center tube may be traced from the *positive* leg of its filament to the bottom or positive side of the grid battery. Thence leftward through the 13½-volt connection, and up through the "Gain Potentiometer" (volume control) to the grid of the tube. The bias of this tube, with batteries in good condition, is therefore 13.5 volts *minus* one-half the drop in the tube filament.

The bias of the left-hand tube is obtained without grid or "C" batteries. The bias resistor connects to the negative side of the filament. It is in the negative leg of the filament supply, and the voltage drop through it provides bias for the grid.

The speech input to this amplifier is at terminals 1 and 2, at the extreme left of the drawing. The voltage ratio of this transformer is governed by the "Low-High" volume control switch. This is mehanically connected with the "Gain Potentiometer" in the following stage, and throws over automatically when that potentiometer is moved from Point 11 to Point 12. This would seem to mean, according to the drawing, that the direction of the motion of the sliding contact is reversed, but actually the knob can be turned continuously from Point 1 to Point 22, exactly like any other volume control.

The d.c. component of the plate circuit of the left-hand tube returns to the filament through the source of "B" supply and the common connection between "G" and "+12V." The a.c. component is by-passed through the condenser shown just above terminals "A" and "B". That branch of the a.c. component that runs through the coupling condenser continues back to the filament through the gain potentiometer and the grid battery.

The coupling arrangements between the second and third tubes, and the third tube and output, are essentially similar. The a.c. component of the output stage, so far as any of it flows through the retardation coil, returns to the filament through the source of "B" supply; while the branch through the coupling condenser returns direct. The output circuit resistor is used or omitted according to the number and type of power amplifiers following, and their input impedance.

The responsibilities imposed on the projectionist by the amplifier shown in Figure 1 are approximately as follows:

1. Charge storage "A" batteries.
2. Charge storage "B" batteries, if used.
3. Clean and water all storage batteries (a total, with "B" batteries, of 150 cells).
4. Observe that tubes are lighted.
5. Read plate and filament currents occasionally by plugging meter cords into the five jacks.
6. Readjust two filament rheostats as condition of storage battery varies.
7. Test "C" battery voltage with portable voltmeter.
8. Clean "C" battery contacts.
9. Clean contacts of filament rheostats and meter jacks.
10. Clean tube socket contacts.

The Circuits of Figure 2

With Figure 1 being representative of 1928, Figure 2 is a typical example of the modern 1935 amplifier.

An outstanding difference between these two circuits is that, so far from needing storage battery or other external power (except 110-volt line a.c.), Figure 2 supplies both high voltage d.c. and low voltage a.c. to other circuits outside itself.

The a.c. supply is indicated by the receptacle circle at the lower right of the drawing, some distance left of the 5-terminal connection block. The 110-volt

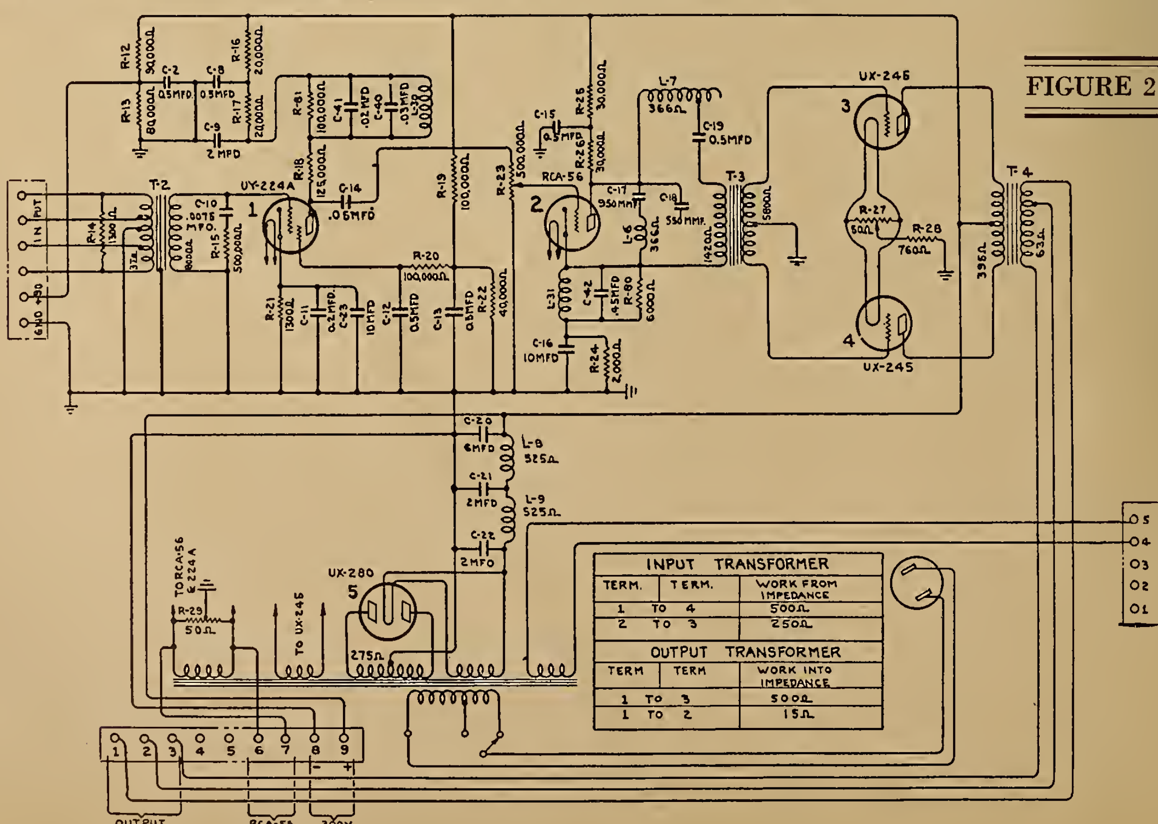


FIGURE 2

circuit runs down and left to the tapped primary of the power transformer. The right-hand secondary of this transformer provides low voltage power to terminals 4 and 5 of the connection block just mentioned, for use outside this amplifier. That power lights the signal lamps of the remote volume control used with this amplifier.

The volume control itself is the 500,000-ohm resistor R-23, shown just left of the Type 56 tube in the center of the drawing. The sliding contact is moved by a small a.c. motor that can be operated from a remote location. A bank of signal lamps at the operating point indicates its setting. The right-hand secondary of the power transformer lights those lamps.

There are no rheostats and no metering arrangements in the filament circuits of Figure 2. The heaters of the two left-hand tubes, types 24-A and 56, are powered by the extreme left-hand secondary of the line transformer, which is also capable of supplying additional current at the same voltage to a single-stage pre-amplifier through terminals 6 and 7 of the connection block in the extreme lower left-hand corner.

The filaments of the push-pull type 45 tubes are heated by the second secondary from the left. There is no occasion for filament rheostats or meter readings, because the filament voltage will always remain the same while the power line voltage stays constant. The tap switch in the primary of the power transformer can be set to compensate for high or low voltage lines. The filaments of the tubes and the operation of the amplifier are not troubled by minor variations in the heating current. Wide fluctuation of power line voltage is, of course, another matter, to be cared for by installation of voltage control equipment.

The plate power of Figure 2 is derived from the full-wave rectifier tube, type 80. The positive output is, of course, at the filament. The line may be traced right, and then upward through L-8 and L-9, past the filter condensers C-20, C-21 and C-22. From the top of coil L-8 one branch can be traced right and then upward to the center tap of T-4 primary; thence to the grids of the push-pull stage. From the filaments of that stage to the center tap of R-27, through the bias resistor R-28. From the ground connection at the negative side of that resistor to the ground connection just right of Resistor R-24, about two inches left of the lower push-pull tube. Thence left and down, past the filter condensers, to the mid-tap or negative of the plate secondary of the power transformer.

Returning to the mid-tap of the push-pull output transformer T-4, another branch may be traced upward and left to the top of R-26, down through R-26 to the plate of the type 56 tube. From the cathode of that tube down through L-31, and right and down through the bias resistor R-24, thence left and down to the center-tap of the plate secondary.

Still another branch runs left from the top of R-26, down through R-19, and left through R-20 to the screen grid of the type 24A tube. Still another branch, following the positive line across the extreme top of the drawing, runs downward through R-16 and R-17, right, up, right, down through R-81, and R-18 to the plate of the type 24A. One more branch runs down through R-12, left, down and left to the "+90" terminal of the left-edge connection block. This provides bias voltage for two photoelectric cells.

The grid bias of the push-pull tubes is furnished by the voltage drop through R-28 (just left of T-4), which is in series with the plate current through those tubes. The grids return to the negative side of that resistor through the common ground connection.

The bias of the '56 tube is supplied by the voltage drop through R-24, through which the plate current of that tube returns from cathode to ground. The grid of the same tube is connected to the ground or negative side of R-24 through the volume control potentiometer. The bias of the control grid of the '24 tube is derived from the drop through R-21, to which the control grid connects through the secondary of the input transformer, T-2.

Speech Circuits of Figure 2

The speech input to Figure 2 is through the four upper terminals of the left-hand connection blocks. The first and fourth are the photo-cell input line, the other two being used for special inputs, as from announcing microphone. C-10 and R-15 are part of the elaborate frequency-controls of this amplifier. The plate of the 24-A type tube is coupled through C-14 to the volume control potentiometer R-23, the drop across which is applied to the grid of the second stage, type 56 tube. C-11 and C-23 are frequency control condensers.

The speech component in the plate circuit of the '56 tube may be traced upward through L-7 and down through C-19, thence through the primary of coupling transformer T-3, and back to cathode. L-6 and L-7, C-17 and C-18 are frequency control devices. The input to the push-pull stage is from transformer T-3, and the output through T-4, the secondary of which is designed for impedance match to the power amplifier following. It is also provided with a tap connection through which it can be coupled directly to the speakers in emergency.

The manner in which the frequency control devices seen in the speech circuits of this amplifier can be adjusted in the theatre to adapt its characteristics to acoustical conditions, recording technique, and other variables not controllable in the factory, is explained in detail in the manufacturer's instruction book, which accompanies each installation. Such elaborate controls were not provided in 1928. The amplifier shown in Figure 2 requires of the projectionist only the following:

1. Throw main line switch on in the morning and off at night.
2. Use of more elaborate test equipment, requiring real electrical knowledge, to find trouble.
3. Understanding of tube types and circuit arrangements not used in earlier equipment.

From these illustrations and the discussion of them the meaning that improved amplifiers have for the projectionist should be obvious. They mean less trouble but more responsibility. Or, to attempt to sum up the difference in a phrase, they substitute the requirement of better and more thorough electrical knowledge for those of cleaning storage battery tops and adjusting rheostats.

NOTES ON LOUDNESS, PITCH

Dr. Harvey Fletcher
BELL TELEPHONE LABORATORIES

MUSICIANS employ three terms to describe different aspects of the sensation they experience when listening to musical tones. These are pitch, loudness, and timbre, although the term quality, or tone color, is sometimes substituted for timbre. Most textbooks on physics have taught that these psychological characteristics are related in a simple way to three corresponding physical quantities: frequency, intensity, and overtone structure.

The relationship between pitch and frequency, and between loudness and intensity, has been thought to be one of direct correspondence: the pitch of each note corresponding to a definite frequency, and the loudness of each note to a definite intensity. The relationship between harmonic structure and timbre has had no such simple formulation, but at least the timbre has been thought to depend on overtone structure alone.

Bell Laboratories Studies

Studies in these laboratories, however, have shown that no such simple relationships exist, that each of the psychological quantities — although depending chiefly on the corresponding physical

quantity—actually depends on all three. That there has not been a strict one-to-one correspondence between loudness and intensity has been known for some time, but only recently has accurate quantitative data been obtained. Between pitch and frequency, on the other hand, it is generally thought that there is a strict one-to-one correspondence.

Frequency is the number of vibrations per second made by the sound source, such as a tuning fork or a violin string. Most musical tones, however, are composed of a series of frequencies which are multiples of the lowest or fundamental. For such tones the frequency of the fundamental is considered as the frequency of the tone, while the number and magnitude of the harmonics produce the overtone structure that results in the perception of a definite timbre. The intensity of the tone is the power content of the air vibrations at the position where the listener hears the tone.

Among musicians loudness is roughly gauged in seven steps running from *ppp* (pianissimo) to *fff* (forte). Such a scale is entirely inadequate for scientific studies, both because the steps are too large and because there is no definitely established reference loudness.

To provide a more suitable measuring scale, it has been the practice for some time in the Bell Laboratories to measure loudness in terms of the power intensity of a pure tone at a frequency of 1,000 cycles per second. Because of the wide range of intensities to which the ear responds, it has been convenient to use a logarithmic scale of values.

The use of such a scale is further justified because the minimum change in intensity that the ear can detect seems to follow more nearly a logarithmic than an arithmetic law.

Although no quantitative measurements have been made upon the timbre of a musical tone, we know that it depends not only upon the overtone structure but also upon the intensity. If a violin tone, for example, is reproduced at a very much higher intensity than that at which it is usually heard, it will be very evident that the timbre is changed.

A scale for representing timbre is now being worked out and it will be interesting to see if some quantitative measurements similar to those reported under loudness and pitch can be made to describe the quality aspects of the tone. It is sufficient to say here that there is no doubt but that the results will show that timbre is dependent not only upon the overtone structure but also upon the intensity and the pitch of the tone.

It is thus a safe conclusion that each of the three psychological characteristics of a tone is dependent on all three of the physical characteristics, although the influence of one is predominant in each case.

FILMS, RADIO AND TELEVISION ASSAYED BY DR. GOLDSMITH

SPEAKING through a tiny microphone no larger than a matchbox, fastened to his coat lapel, a device he described as "permitting one man to be heard above a multitude", Dr. Alfred N. Goldsmith, noted scientist and consulting engineer of the RCA Manufacturing Company, described and demonstrated recently some late scientific developments from the leading radio research laboratories to more than 400 guests of the Cleveland Chamber of Commerce. The address was broadcast over a nationwide radio hookup.

The lapel microphone worn by Dr. Goldsmith utilizes the "velocity" principle of operation in which reproduction is obtained by the varying impact, or velocity of the human voice on a sensitive metallic ribbon within the mechanism. With this device a public speaker can move about freely without impairing the quality of the sound.

Pointing out that we already hear and will eventually see by radio, Dr. Goldsmith suggested that in the remote future radio might appeal to man's other senses, such as touch, taste and smell. For example, he said, there was the possibility of transmitting three-dimensional replicas of objects in the studio through "Teletactile Broadcasting", so that a solid representation which "might even be touched as well as viewed could be sent into the home." "Telegustatory Broadcasting", or the transmission of taste, might make it possible to "taste" a fine brand of coffee, for instance, by radio. The transmission of smells would perhaps be easier, he said, since the "Telolfactory" receiver need only spray into the air a duplicate of the odor transmitted. He emphasized, however, that these possibilities were now "only whimsical and remote imaginings".

Sound Picture Progress

To illustrate the remarkable progress which has been made in improving the quality of sound motion pictures, Dr. Goldsmith demonstrated for the first time in public a radically new system of high quality sound-on-film recording which, according to RCA engineers who developed it, will be the "motion picture sound of tomorrow", because it completely eliminates background hissing noises and, theoretically, makes possible the ultimate of realism in sound-on-film recording and reproduction.

Using a special film recording of a musical performance in the Radio City Music Hall in New York, Dr. Goldsmith called attention to the ability of the new system to reproduce the full definitions and shadings of all the instruments in the orchestra over the complete audible range of sound, as well as to the complete absence of hiss during the quieter portions of the music. With the new recording method, the sound waves are halved into two separate but symmetrical sound tracks, one negative and the other positive, automatically eliminating the unused portions of the sound track which is a necessary part of all existing sound-on-film systems.

Speaking of the development of facsimile picture transmission, or the transmission of "still" pictures by radio, Dr. Goldsmith said that ultimately facsimile transmission will become a public broadcasting service of great popularity. Any printed or pictorial material will, sooner or later, be capable of speedy transmission instantaneously into a multitude of homes provided with simple automatically-functioning receiving equipment.

While describing the steady and orderly development of television experimentally as amazing, Dr. Goldsmith felt it necessary to temper optimism with a note of restraint in discussing the future of television broadcasting. The problems of television extend beyond purely technical considerations of transmitter and receiver, he said.

There is the tremendous economic problem of launching a nationwide television service, when the cost of connecting numerous broadcasting stations of only limited service range in a network is at present staggering. Then there is the question of supplying almost overnight a demand for talent which will be pleasing to the eye as well as the ear in such quantities as would drain the available supply in Hollywood, for instance, in a very short time. Then there is the important question of who will pay for the high cost of putting this talent on the air, for commercial sponsors would be called upon to pay a substantial portion of the cost of a feature-film production for an hour's broadcasting. That these problems will be solved in time Dr. Goldsmith did not doubt, but it is evident, he said, that much must yet be accomplished in the interim.

A remarkable new device called an oscillograph was connected to a number of radio receivers to permit everyone to "see" the characteristics of the human voice or other sound in the form of fluctuating waves. A stream of electrons, otherwise known as a cathode ray, paints a continuous picture of the sound waves on a glowing, or "fluorescent" screen. The oscillograph, according to Dr. Gold-

smith, is expected to become to electrical, physical and mechanical research and development what the X-ray is to diagnosis in medicine. Originally designed for radio service men and engineers, it is finding seemingly limitless applications in many other fields, including certain phases of the aviation, automotive, and public utility industries.

Other new devices described by Dr. Goldsmith were a new type of radio tube, resembling an acorn in size and shape, for use by radio amateurs and experimenters in exploring the possibilities of the ultra-short micro radio waves; an amateur sound camera which makes it possible for anyone to make his own sound movies as easily as silent movies; a small chest, resembling a cigar humidor which when connected to any electrically operated radio receiver converts it into a phonograph combination instrument. It can be played from a convenient chair at a distance from the receiver to which it is connected. Also, a "Caruso record which Caruso never heard", a phonograph record which ingenious engineers have been able to literally recreate from the original one made by Enrico Caruso so that now many years after his death Caruso's immortal voice may be heard with a new brilliance to the accompaniment of a large modern orchestra.

Studios Finally Move to Correct Varying Print Densities Evil

STUDIO laboratory and camera department heads met recently at United Artists Studios to witness a screen illumination demonstration prepared by the Academy Research Council consisting of sample prints from each studio, projected at various high- and low-intensity illuminations, and designed to demonstrate the difference between the illuminations on the screens in the Hollywood studio viewing rooms as compared with theatre screen illumination throughout the country.

The demonstration is part of the investigation which has been going on for some months on the feasibility of bringing studio projection room screen illumination characteristics closer to the conditions prevailing on the theatre screens, and is important because of the fact that pictures made in the studios are judged, insofar as camera and laboratory work is concerned, on screens which in many cases are considerably brighter or duller than the theatre screens upon which the public will later view the same picture.

Studio Questionnaire

At the conclusion of the meeting, each technician present was given a questionnaire and asked to write up his ideas and opinions of the demonstration, for use by the subcommittee in preparing their final report for presentation to the Research Council and the producing companies.

Print density has long been a problem of major importance in the projection field. The Projection Practice Committee of the S. M. P. E. has repeatedly urged that an investigation of West Coast print procedure be made with a view to effecting improvements in exhibition. Following is an excerpt from the Committee report for 1932:

"It has been definitely established that the intensity of screen illumination in most studio projection rooms is greatly in excess of the intensity that can be obtained in theatres. The great disparity existing was pointed out in a report of the Theatre Lighting Committee published in the February, 1931, issue of the S. M. P. E. *Journal.*

"Complaints regarding dense prints persist, however, indicating the need for additional emphasis in the matter.

"The Projection Practice Committee has conducted a partial survey of typical theatres for the purpose of determining the values of screen illumination obtaining in practice, and it is significant that its findings, in a widely separated territory and after a lapse of two years, check closely with the findings of the Theatre Lighting Committee previously referred to.

"The results of these two independent surveys indicate that the average intensity of the projected light at the surface of theatre and screens lies between 8 and 12 foot candles, and that the average coefficient of reflection is about forty per cent, corresponding to intensities between 3.2 and 4.8 foot-candles, these figures being based on the use of diffusive screens.

"In tests made by the Committee, each projector was equipped with a two-blade 90-degree shutter which caused a reduction of approximately 50 per cent of the screen illumination, as compared with measurements made when the projector was at rest. In each test the auditorium illumination approximated that obtaining during the presentation of pictures.

Studios vs. Theatre Practice

"Invariably much smaller pictures are projected in the studio projection rooms than in the average theatre, resulting in excessive screen illumination. In addition, reflective screens are sometimes used in studio rooms, adding further to the brightness of the picture. In the great majority of theatres, however, not only are much larger pictures projected than are shown in the studio rooms, but diffusive screens are used.

"Obviously, under such circumstances it is extremely difficult to reconcile studio 'screen values' with theatre 'screen values', unless some compensating adjustment is made in the studio room. It seems highly desirable that no reflective screens be used in studio rooms in which print density is to be judged.

"On the basis of these facts, therefore, and in view of the easy and inexpensive manner in which the requisite change can be made, the Committee suggests that in each studio projection room where the screen illumination is excessive, each projector be provided with a diaphragm or iris in front of the lens to reduce the flux of projected light while measurements of screen illumination are made.

"The iris can be so adjusted that the screen reading approximates the average value obtaining in theatres, after which a diaphragm mask having a fixed aperture of the proper size can be substituted at will for the iris."

S. M. P. E. Now Official Standards Body

The S. M. P. E. has been named sponsor of a sectional committee now being organized by the American Standards Assoc. to work on standards for motion picture apparatus. Regarding this work, the Association commented:

"A sectional committee is now being organized to work on standards for motion picture apparatus, the S. M. P. E. having been named sponsor of the committee. The scope of the work has been defined as 'Terminology, Dimensional Standards, Methods of Test and Rating, and Performance characteristics of the materials and devices used in sound motion picture photography, and in sound recording, processing, and reproduction in connection therewith.'

Representative Group

"The organizations invited to name representatives on the committee include technical or engineering societies interested in motion pictures, electricity, radio, acoustics, fire protection, lighting, and optical science, manufacturers and distributors of kodaks, films and other equipment, theatre owners, exhibitors, producers and distributors, and U. S. Government departments."

Propose Senate Inquiry of A. T. & T. and Affiliates

Investigation of the American Telephone & Telegraph Co. was proposed in a joint resolution introduced on Jan. 24 by Senator Wheeler and Representative Rayburn, chairmen of the respective Interstate Commerce Committees, according to an Associated Press dispatch from Washington.

The resolution calls for an appropriation of $750,000 and would enable an extensive inquiry into the communications field, including an investigation into so-called propaganda issued by A. T. & T. and also into the workings of its various subsidiaries.

EFFECT OF APERTURE LENSES ON ILLUMINATION

Wilbur B. Rayton

Projection optics is the most generally misunderstood link in the reproduction train and the topic of much misinformation. The accompanying paper, originally read before the S.M.P.E., reflects the opinion of an acknowledged authority on optics on a means for improving evenness of screen illumination.

THE illumination of a projected motion picture image for any given combination of light source, light collector, and projection lens is a subject so complex that any approach to full comprehension of all its details can be attained only after prolonged study. This fact may be responsible for the proposal of numerous schemes for improving illumination, either by increasing its total quantity or by improving its distribution, that at first sight look plausible, but do not always work out as expected.

It is to the application of one such proposal in the projection of standard 35-mm. film that attention is here directed. It is a suggestion the principal aim of which is to improve evenness of illumination. Since relatively few have occasion to keep in mind all the details of motion picture illumination, it seems advisable first to outline briefly the two types of illuminators in common use.

The ideal illuminator for motion picture projection would be a light source of uniform and sufficient brightness and as large as the aperture in the film gate, but not so hot as to damage film when placed practically in contact with it. If such a light source were available, a motion picture projector would reduce to the form shown in Fig. 1. Illumination would be even over the area of the picture except for two facts, one of which we shall ignore, and the other of which is demonstrated in the figure.

Reversing the Light Path

It is much more convenient in studying this problem to think of the light sometimes as traveling from the screen to the film; at other times it may be more convenient to think of it as traveling from the light source to the screen, in the normal manner. The reversibility of a light path makes such a procedure entirely justifiable. At present we shall think of it as traveling from the screen toward the light source.

In Fig. 1 two beams of light are shown, one focusing at the center and the other at the corner of the aperture. The one that focuses at the center of the film aperture fills the front of the projection lens, but the oblique beam does not. Any light belonging to the latter beam that falls on the front lens higher than the upper ray shown will be stopped by the mounting of the rear lens. In a few cases there may be none of this vignetting of the oblique beams, but it is generally found in lenses of any considerable length.

This reduction in the effective aperture of the lens for oblique beams results in a reduction of brightness at the margin as compared with the center, even if the source of light were ideal, as here assumed.

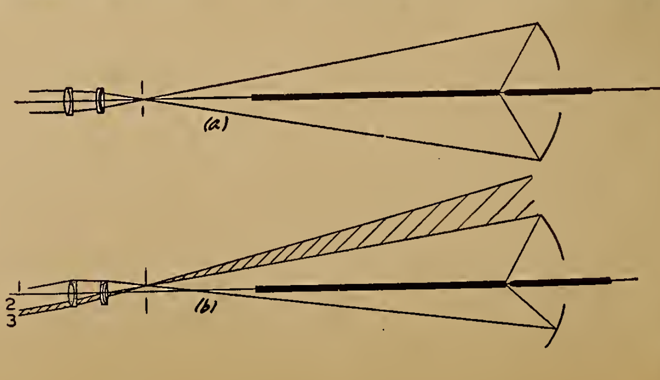
Unfortunately, no source of light even remotely approaches such conditions. Available sources that are bright enough are not only tremendously hot, but are also too small, so the science of optics is called upon to make the available sources of light serve our purpose. To get away from the danger due to heat, it is obvious that it is necessary to move the source of light farther from the film. To overcome the difficulty due to the insufficient size of sources the well-known optical law is applied; stating, that by means of a collective element, such as a condenser lens or a concave mirror, a source of light can be made to behave as though it were of any desired size, without any more than a minor reduction in its intensity.

With a given light collector, the maximum size the source may be made to appear is the diameter of the collector (condenser lens or mirror). In practice it is not always possible to make the light source appear as large as desired because practical considerations limit the size of the light-collector.

The laws of optics set a definite limit to the size attainable in condensers and mirrors of a given focal length; and, generally, the laws of economic limitations become effective before the optical limitations do. Larger condensers and mirrors could be made and some improvement in illumination achieved thereby, but the cost would become prohibitive.

Since light collectors can not be made as large as they should be made, certain undesirable consequences follow, which will now be examined briefly. There are two cases. The simplier one is presented by customary practice in reflector arcs and will be considered first. Fig. 2 represents an assembly of a 5-inch projection lens of the Cinephor type, a standard aperture, an arc with an 11-mm. positive carbon, and an elliptical mirror 11.5 inches in diameter. The arc is imaged in the plane of the film or very near it. To study this case it is helpful again to consider the light

Right: *FIGURE 2*



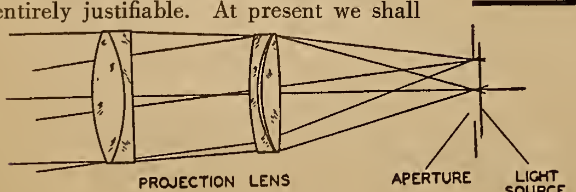


FIGURE 1

as proceeding from the screen to the arc.

Fig. 2*a* shows the beam of light involved in imaging the center of the picture and Fig. 2*b* an oblique beam that images a point at the corner of the picture. For the center of the picture the mirror is large enough to fill an area of the lens corresponding to a relative aperture of about *f*/2.8. A beam of light of that diameter entering the lens would focus at the center of the film aperture, diverge from the focal point, and just fill the mirror. Since film aperture and arc crater are conjugate foci, the beam after reflection by the mirror would come to a focus again at the center of the crater.

Action of Light Rays

The oblique pencil of light is indicated by three rays, 1, 2, 3, which divide the beam into two zones. Ray 2 is a limiting ray, the position of which is found by joining the upper edge of the mirror to the corner of the film aperture. Ray 1 is another limiting ray, the highest ray that will pass through the projection lens at that angle. The two rays, and any that lie between them, will participate in imaging the corner of the aperture upon the screen, but they do not include the whole lens aperture. Rays between 2 and 3 are unavailable because the mirror is too small. The oblique beam is limited on one side by the size of the mirror and on the other by the construction of the projection lens. It is smaller than the central beam, and the illumination at the edge of the screen is correspondingly less than at the center.

It should be noted that an additional complication is introduced by the obstruction of light by the carbons and carbon-holder. As a consequence, both central and oblique beams have irregularly-shaped holes in the center. The obstruction is slightly greater for oblique than for central beams. The difference is not great from the absolute standpoint, but inasmuch as the oblique beam is of smaller cross-section than the central one, the relative reduction is considerably greater in the former.

If, as in this case, the arc is imaged at the film, the question of arc size is easily settled. If the image of the arc fills the aperture, it is large enough; otherwise it is not, and the margin of the picture will receive no direct illumination.

The question of arc size is not so easily disposed of in the next case, however, which is typical of all condenser combinations. Because of insufficient magnification, the source can not be imaged in the plane of the aperture but must be imaged at some distance ahead of it in order to get light to the margin of the picture, making the geometrical optics somewhat more complicated than in the case of the reflector arc.

Illumination in the center of the field may be limited either by the size of the condenser or by the size of the light source; according to adjustment it will be one or the other, but not both. In the margin of the field both size of condenser and size of source are likely to be limiting factors.

The conditions are brought out in Fig. 3, which shows the combination of a 5-inch Super-Cinephor projection lens, the most efficient condenser system in common use, 6 inches in diameter, and a 13.6-mm. high-intensity carbon arc as source.

Fig. 3*a* shows the beam of light concerned in imaging the center of the field. Fig. 3*b* that concerned in imaging the corner of the picture. The drawings are made to scale. The lens has a relative aperture of *f*/2.3; the condenser, with reference to the center of the film aperture, of *f*/2.37. The condenser is, therefore, large enough practically to fill the aperture of the projection lens for the central point of the image.

If we trace the rays limiting a beam of *f*/2.37 through the system, they fail completely to strike the crater of the arc, proving that the crater of the 13.6-mm. carbon is not large enough to utilize the full aperture of the projection lens. If we seek the location of the rays that just strike the edge of the crater of the arc, we find that they occupy the positions marked *B*, *B*, and that the beam of light they enclose corresponds to a relative aperture of *f*/4.8 in the plane of the drawing and *f*/6.7 in a plane at right angles to the drawing, the difference being due to the fact that the back lens of the condenser is a cylinder.

Actual Light Source

It would seem from the drawing that all that would be required to utilize the aperture of *f*/2.37 would be to pull the arc back from the condenser to the point where the limiting rays *A*, *A* intersect. This is true, but it would leave the margin of the picture with little or no illumination. The position chosen for the arc is the result of a compromise between central and marginal illumination.

To digress a moment, the dimensions of the actual source of light in the case of the high-intensity arc are rather indefinite. The diameter of the hottest central area for the 13.6-mm. carbon is 8 millimeters, as nearly as can be measured. This is surrounded by a ring about 2.2 millimeters wide which must also contribute considerable light, but is by no means as bright as the central area. The relative apertures just mentioned are computed for the central 8-mm. area from which most of the light emanates; but the figures do not represent the complete story, because zones of the lens not active according to this analysis actually do transmit light to the screen from the ring of carbon surrounding the central gas-ball.

As experiment supports the conclusions drawn from a study of the problem in which the 8-mm. central area was regarded as the sole source of light, we can feel fairly safe in ignoring such light as is contributed by the outer ring of the crater.

Referring again to Fig. 3b, four rays are shown. Ray 1 is the highest ray that can pass through the projection lens and arrive at the corner of the aperture. Continued through the condenser we find that it will not strike the crater of the arc; therefore it can not exist in actual projection.

Ray 2, after being refracted through the lens and passing the corner of the aperture, is refracted by the condenser to the lower edge of the crater. The useful area of the lens on the lower side is limited by the size of the crater. Ray 3 is determined by a line joining the corner of the aperture with the edge of the free aperture of the condenser. After refraction by the condenser it strikes the arc, and therefore it exists in actual projection.

Any ray lower than 3, such as ray 4, fails to strike the condenser; therefore ray 3 limits the useful area of the lens on the lower side and ray 3 is determined by the size of the condenser. The zone between rays 1 and 2 is useless because the light source is not large enough, and the zone between rays 3 and 4 because the condenser is not large enough.

This setting of the arc-to-condenser distance is found, however, to be about the best compromise between the desire for maximum illumination and even

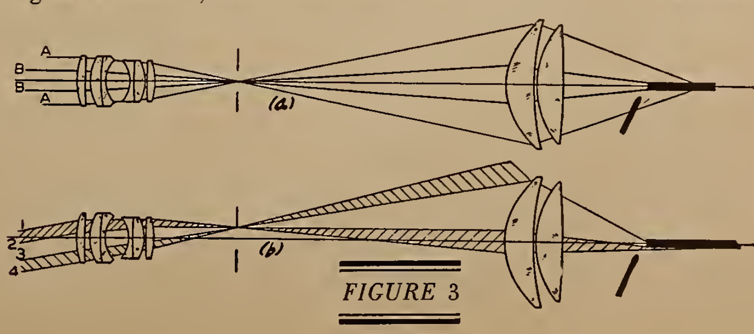


FIGURE 3

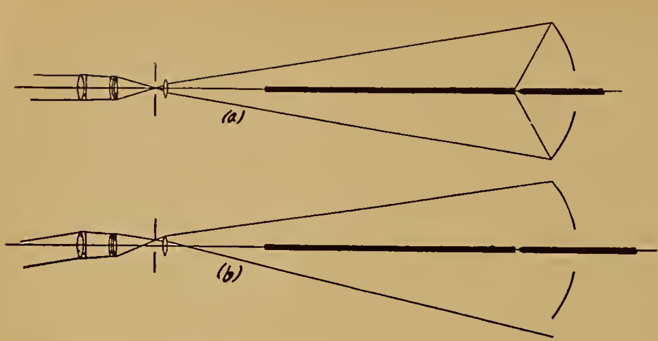


FIGURE 4

illumination. Such an adjustment will afford an illumination at the edge of the picture of approximately two-thirds that at the center. By pulling the arc back somewhat, the brightness at the center can be increased, but the brightness at the margin of the picture will suffer.

The ratio of the useful areas of the lens for central and marginal image points, is found, for this adjustment. to be practically the same regardless of the type of projection lens, at least for projection lenses as different in form as the Super-Cinephor, the Cinephor, and the type consisting of two widely separated cemented doublets.

It is practically inevitable under the conditions thus set forth that the illumination should be brighter at the center of the picture than at the edge. By suitable adjustment it is sometimes possible to approach equality of illumination over the whole screen area, but only by sacrificing in total illumination.

Unevenness of illumination has been especially troublesome in projection from behind a translucent screen, where the center of the picture usually appears so much brighter than the edge that the question promptly arises as to whether something can be done about it in the projector. Usually nothing can. The effect is almost entirely due to the character of the space distribution of light transmitted through the screen. With a screen that is a perfect diffuser no serious trouble would exist, but a perfectly diffusing screen would transmit so little light in any one direction that the image would appear too dark to be satisfactory.

Aperture Lens Suggested

One of the suggestions that have been made is to place a collective lens close to the film. Such lenses have been called aperture lenses. In so far as any effect on illumination is concerned, they might be placed ahead or behind the film with equal effect; but since, if placed ahead of the film, they would become essentially a part of the projection lens and have a bad effect upon the image quality, it is impracticable to place them there.

Fig. 4 shows the application of a lens of this kind to the optical system shown in Fig. 2. Two interesting results follow. In the first place, the angular aperture of the beam of light converging to the central point of the film aperture is increased, with the result that a greater area of the projection lens is used and there will be more light at the center of the screen. This is shown in Fig. 4a.

This result is misleading, for it is accompanied by a reduction in the size of the image of the arc formed by the combined reflector and condenser. If that image were originally of just sufficient size to cover the aperture it would no longer cover it, and the distance from the mirror to the aperture would have to be increased to restore the arc image to the necessary size. The gain in illumination apparently attained would be lost by the readjustment. If the arc image were originally larger than necessary, the same gain in illumination might have been attained without the aperture lens, by decreasing the distance from the mirror to the aperture and refocusing the arc, thus reducing the size of the arc image and increasing the angle of convergence of the beam of light.

These effects are exactly compensatory. and the conclusion is that no gain in illumination at the center of the field is to be achieved by means of an aperture lens that could not have been attained by a different adjustment of the distances from arc to reflector and reflector to aperture. Since the necessary degree of freedom of adjustment may not be present in a given lamp. however, it would not be safe, in any particular case, to conclude that an aperture lens would not provide increased illumination.

One Undeniable Advantage

A comparison of Figs. 2b and 4b, however, discloses an undeniable advantage in the use of the aperture lens. Whereas without the aperture lens the oblique beam, because of its inclination to the axis, in part fails to strike the reflector and in part fails to utilize other areas of the mirror, the addition of an aperture lens of approximate power will deviate the entire beam, causing ray 4 (Fig. 2b) to strike the mirror and lowering the point of incidence of ray 1.

In fact, the whole area of the mirror may be made to contribute to the formation of the image of a point in the margin of the field; leading, therefore, to a level of illumination at the edge more nearly equal to that at the center. In addition to that effect, which is inevitable, there may be in some cases an increase in illumination at the edge of the field of the same nature as that described above as possible for the center of the field.

Actual tests with an 11½-inch elliptical reflector, and 11-mm. carbon at 70 amps., and a 5-inch Super-Cinephor projection lens led to an increase in average brightness over the entire area of the screen of 25 per cent.

On the other hand, the condition represented in Fig. 3 can not be improved by the addition of an aperture lens. By examining Fig. 3 it can be seen at a glance that a collective lens placed immediately back of the aperture could indeed change the direction of ray 4 and all other rays between 3 and 4 sufficiently to cause them to strike the condenser, whereas they now miss it completely. The gain, however, is offset by the fact that ray 2, which is now a limiting ray of the active beam, determined by the fact that it is the highest ray that will actually strike the crater of the arc, will not meet the arc if an aperture lens be introduced.

The highest ray that will strike the arc will be lower than ray 2, and what is gained by an apparent widening of the useful beam on the lower side is compensated by a loss on the upper side. The only change is that we shall now be using a different area of the lens for imaging the corner of the picture.

The essential difference between the two typical cases is that in the first case the only limitation of the size of the beam of light, both at the center and at the margin of the picture, is imposed by the size of the light collector. In the second case, both the light collector and the light source are too small for the conditions under which they are used.

In the former case an aperture lens improves evenness of illumination, and in case the light source is large enough it can increase the illumination over the whole picture more economically than by increasing the diameter of the reflector. In the second case, the introduction of an aperture lens does not appear profitable from theoretical considerations, a conculsion which is supported by experimental observations.

ONE WAY OF DOING IT

Leo Amato, projectionist at the Strand in Wallace, Idaho, was severely burned when he grabbed a reel of blazing film and hurled it through a window.

The IP EDITORIAL PAGE

Vol. 8, No. 1 JANUARY 1935

This 'Extended' Service by Electrics

There is no point in grabbing a baseball bat as a means of resistance to the electrics' extended theatre servicing plan. The right of the electrics to engage in servicing operations, upon whatever scale they choose, is as indisputable as the right of projectionists to band into Unions and offer projection manpower. It is just too bad that the interests of electrics and projectionists happen to conflict in this particular instance. If projectionists choose to stand aside and make way for an extension of servicing work by the electrics, that is strictly their decision to make —not ours. Of course, it is to be hoped that Labor will take the consequences of such a decision with the same grace manifested now in stepping aside.

There have been serious abuses in sound system servicing to date in this field. Beginning in 1928 the electrics socked this business for every nickel they could squeeze out of it, and their antics with respect to ten-year contracts, patent hooey, weekly charges, the forced sale of parts, a goodly portion of which were absolutely unnecessary, and general all-around pig-headedness in matters concerning the general welfare of the industry are items for careful cataloging. Not to mention incredible compound interest manipulations, a stiff-backed resistance to change in design of equipments in conformity with progress in the art, and a studied policy of concealing the truth in sound equipment matters of interest to the industry at large.

Fairness demands that an exception to the foregoing be filed in behalf of RCA. This company represents one of the most beneficial influences in this industry since the introduction of sound pictures. Fair in all its industry dealings, whether to exhibitors in the matter of equipment sales and service or to Labor and the press in matters directly affecting either or both groups, RCA has earned special consideration in this field. Labor in particular has had no better friend in this business than RCA.

Further, RCA never attempted to "hog" industry activities in either exhibition or production. Its technical progress is noteworthy: it was the first to introduce all-A. C. operated equipments; it was the first to openly advocate the junking of cumbersome storage batteries, while others clung tenanciously to their use and resented any implication that batteries were less than perfect powering devices; it was first in the matter of outright sale of equipments, as well as the first to abolish compulsory servicing, and it has consistently worked toward simplification and improvement of its equipment. In addition, RCA recording has constantly improved and today it is superb.

Even now, in the face of some rather hard knocks emanating from these columns, RCA has, in refreshing contrast to other companies, come forward and given frank and honest expression to its policy of extended servicing operations. This out-in-the-open action is just another indication of the liberal RCA policy in this field.

RCA's statement of position relative to extended theatre servicing work, as outlined elsewhere in this issue, including its attitude toward exhibitors, supply dealers, manufacturers and Labor, is accepted by this publication at its face value. In fact, the experience of this publication with RCA, its contact with RCA representatives, impels the statement that this publication will accept RCA's word for anything; and it recommends that its readers do likewise not only on this question of servicing but in all matters. RCA's record in this field demands nothing less.

The only way in which the electrics can avoid the consequence of bitter opposition to their extended servicing plans is to concede the rights of all interested parties. A policy of silence and the attempt to so misuse words as to cloak their real intentions will be fatal to the orderly development of the electrics' plans. Labor has a vital interest in the ultimate effect of any extension of servicing operations by the electrics. Labor should have awakened long ago to the menace to its security of sound servicing by the electrics. Manufacturers can shape their courses as they please, due consideration having been given to the policy of the electrics to date in adopting as "standard" one certain type of equipment and then forcing it into theatres by right of sale and servicing contracts, to the exclusion of all other makes.

Supply dealers have already arched their backs and announce a fight to the end with the electrics. It seems a bit naive to suppose that the electrics, once their extended servicing plan is in operation, would be content to merely "recommend" certain types of equipment and thus pass up an opportunity for substantial additional income in the form of discounts.

It is to be doubted that exhibitors, many of whom have been but recently freed from the electrics' clutches through the expiration of service contracts, will now turn about and again invite the electrics to participate on any broad scale in the operation of their theatres. Some theatre groups, by reason of heavy indebtedness to the electrics, have practically no choice in the matter, of course, yet it should be remembered that the success of the electrics' plans depends not on chain contracts but on signing the thousands of independent theatres in this country, estimated to approximate 81% of the total.

Then, too, it might be bad medicine for the electrics if their activities in the sound picture field today are brought to the attention of the Government, which will embark shortly upon an exhaustive investigation of communication companies. Not only bad medicine; it might well turn out to be deadly poison.

INTERNATIONAL PROJECTIONIST is, of course, unqualifiedly and unalterably opposed to any extension of servicing operations by the electrics, without exception. It recommends unrelenting opposition by its readers to any

(*Continued on next page*)

NEW VISTAS IN SOUND TRANSMISSION

Leopold Stokowski

CONDUCTOR, PHILADELPHIA SYMPHONY ORCHESTRA

Rated by many as the world's foremost conductor, Leopold Stokowski evidences herein his keen insight into the technical requisites of good sound transmission, the result of participating in extended technical tests for several years now. Appearing in "The Atlantic Monthly" (Jan., 1935, Vol. 155 No. 1), this article appeared mightily to this writer, whose unshakable conviction it is that projectionists are keenly interested in the allied arts as a means of broadening one's perspective of the whole field of sound transmission. To be presented in installments, of which this is the first.—Editor.

IS THERE any difference between listening to music directly and by radio? I have tried to meet this question in two ways: first, personally and subjectively, as one who has devoted all his life from childhood to making music and trying to understand its true inner nature; and, secondly, objectively, impersonally, trying to find the facts as registered, not by ear, but by instruments of precision.

When we listen to music directly the factors involved are complex, but they can be grouped into three classes: (1) the sound source—singer, violinist, orchestra; (2) the conveying medium, the air between the sound source and our ears; (3) the receiving medium—our ears, which receive the music or vibrations and pass them to those centres in our brain which transform them into states of being and feeling.

Now what happens when we listen to broadcast music? Obviously (1) the sound source and (3) the receiving medium remain the same. But (2) the conveying medium is only similar in the space between the loud speaker and our ears. Before that is reached many new factors enter. Again these factors are complex, but they can be classed in three groups:—

Three Important Factors

(A) *Pick-up.* This includes the varying characters and patterns of the sound waves created by the instruments or voices in an empty or full hall, or in a small or large studio, modified by the kind of reflecting or absorbent surfaces formed by the walls, ceiling, floors, and whatever persons or objects there are in the enclosed air-volume. Other variants are the type of microphone used, its degree of responsiveness to various zones of the total audible frequency range, the number of microphones, and the relation in space of all the instruments and voices to each other and to all the microphones in operation.

(B) *Transmission.* This is a very complex process that presents problems for which no one as yet has a complete answer. But one element—amplification—can be understood by every music lover. It resembles in some ways the enlarging of a photograph. If we were to take a negative, and enlarge some parts slightly, other parts to twice their original size, others to four times the size, the result would be a distortion, interesting perhaps to those who enjoy the fantastic, but not a true reproduction of the original picture on a larger scale.

In the transmission of music, amplification is necessary, but if the amplification is greater in some zones of the whole frequency range involved, certain tones or groups of tones sound relatively louder than others, the harmonies become unbalanced, certain individual notes in a melody stand out suddenly in too great relief, important harmonics or overtones are too weak or too strong, the tone-color or timbre of the instruments or voices is changed and degraded, and the whole tonal mass is thrown into a chaotic state of distortion. The result becomes a caricature, and discriminating music lovers will prefer not to hear in a degraded form music they know and love; and those who hear the music for the first time can have no conception of its true beauty, or of the inspired message it conveys.

To keep the picture simple I have spoken here only of the distortion brought into music by amplifiers; this is

(*Continued on page* 27)

Editorial (*Continued from page* 21)

such plan. It advocates the assumption of all theatre servicing work, of whatever character, by projectionists. To the *sub rosa* charge that projectionists don't know a Hell of a lot about sound system servicing we reply that the electrics at present know a Hell of a lot less than do projectionists about projection equipment, the electrics today being in much the same position with respect to projection that the projectionists were in in 1927-28-29 relative to sound equipment.

Projectionist organizations throughout the country number among their members ample manpower well qualified to do just as good a sound servicing job as the best men possible of muster by the electrics. This publication urges immediate action—and it means *immediate action*—by projectionist organizations everywhere to obtain servicing work. Failing to take such action, projectionist organizations might just as well lock up their headquarters and throw the key away, for they will be washed right out of the picture by the tidal wave of electrics' domination.

Wage Scales on a National Basis

The only justification for the appearance herein of news and comments pertaining to projectionist wage scales is the fact that somehow or other wage scales seem to be inextricably tied in with the quality of projection work rendered. Low scales invariably mean a lack of interest in and inattention to one's job. This is freely admitted by all reasonable persons.

There is another angle to this scale question. Projectionists in, let us say, California seem strangely apathetic to the wage scale fortunes of their craftsmen in, let us say, Connecticut. Why? we ask. Don't the California fellows, for example, know that wage scales in Connecticut ultimately affect their own scales? It isn't so, do we hear somebody say? Let's see.

Two recent trade press items are served up in support of our contention. First, a theatre concern in St. Joseph, Mo., demands as the basis of settlement of a controversy with an I. A. unit the reversion to one-man shifts—*pointing out that many other I. A. units have granted such a concession, and even going so far as to name specific theatres in specific towns.*

Second, during the recent Chicago wage scale negotiations the exhibitors demanded an agreement embodying a basic hourly rate for a theatre of certain seating capacity and charging a certain admission price. The Chicago exhibitors *pointed to the recently published tentative wage scale agreement promulgated by the NRA Fact-Finding Committee for New York City.*

Got enough? Or shall we go on?

NEWS NOTES

ITS work concluded, the Fact-Finding Committee appointed by the NRA to investigate the matter of New York City projectionist scales has released for publication, through the NRA, the tentative scale schedules arrived at after months of consideration by the Committee, composed of theatre owners and managers, I. A. officials and NRA representatives. As is well known, the I. A. is now directing Local 306, N. Y. unit of the Alliance.

The proposed scales, published on this page, will be the topic of an open hearing to be held in Washington on February 1, the date now set after three postponements. The rank and file of Local 306 is reported ready to offer vigorous objection to the projected agreement, claiming that they were not represented in the negotiations. The General Office of the I. A. is understood, however, to be planning a meeting of Local 305 prior to the Washington hearing.

Many Important Provisions

The Committee schedule is important in many respects. First, the scales per hour are based upon seating capacity and admission price, it being possible, naturally, for the latter to change as many as three times a day for a. m., p. m. and after-dinner performances. The scale probably reflects the top price charged by a theatre during the day.

Second, there is a limitation of hours to 30 per week per man. Third, the minimum rate for any theatre (total theatre cost) is set at $60 weekly. Many independent theatres in New York are now paying a total of only $35 weekly, and have been with impunity since the code became effective.

Fourth, the proposition involves a ten-year contract between Labor and the theatre owners, with the first revision limited to not sooner than two years after the scale becomes effective. (This has long been a pet project of N. Y. theatre owners.) Naturally, such revision would follow the arbitration route, as provided in the agreement.

Fifth, in anticipation of stiff cuts, a limitation of 33 1/3% is placed upon the extent of any reduction in scale. Editor Kann of *Motion Picture Daily* estimates the *annual* savings to circuit operators will be $580,000, split as follows: Loew's, $312,000; RKO, $218,400; and Skouras, $52,000. Broken down, these figures mean a *weekly* saving to Loew's of $6,000; to RKO of $4,200, and to Skouras of $1,000.

It is understood unofficially that I. A. acceptance of the scales is predicted upon the ability of the theatre owners to deliver New York City as a 100% Union town. At present there are three N. Y. unions: Local 306, I. A. unit; Empire, the first love of the exhibitors in their fight on L. 306 but which in 1933-34 was very friendly to L. 306; and finally, the Allied Union, conclusively proven as having been formed by the exhibitors with their money just prior to the NRA and which was adjudged a "company union" by the N. Y. State Supreme Court.

Future of Dual Unions

Nothing definite is known about the future of Empire and Allied should the tentative scale be adopted, and should I. A. succeed in forcing delivery of a 100% Union town. Local 306 at present has 1800 members; Empire has about 500, and Allied 100, a total of 2400 men. Well-informed opinion holds to the view that, on the basis of two-men shifts, New York City can offer at most 1800 projection jobs. The question arises, in the event of consolidation into one large I. A. unit, what is to be done about the other 600 men? The answer obviously lies in the proposal for a 30-hour weekly maximum per man. Nobody is apparently even thinking about the possibilities of one-man shifts.

On this basis a theatre of 1,000 seats in the highest admission class (40c and more) would pay a total of $1.75 per hour for projection. Assuming a two-men shift, each man would receive 87½c per hour; and being limited to 30 hours weekly, he would receive $26.25 for a weekly wage. The smaller exhibitors are protesting vigorously against even this scale.

Dubinsky Row Ended

The long-standing row between Dubinsky Bros. Theatres and the I. A. unit in St. Joseph, Mo., has ended, with the theatres replacing non-affiliated workers with I. A. projectionists. The former threaten to appeal to the Regional Labor Board, charging that they are being discriminated against under NRA provisions.

The crux of the bitter battle, raging since last Fall, was the Union's demand for two-men shifts, with the Dubinskys in reply pointing to *one-man terms granted by Local Unions in other cities.* Kansas City projectionists, who also locked horns with the Dubinskys, are working under terms of an arbitration decision, the nature of which appeals not at all to the K. C. men but which, under NRA procedure, is final.

Code Authority Expense

The Code Authority for the picture business spent $204,166 during 1934. The C. A. main office in N. Y. cost $80,720, the Hollywood office was $17,617, while the local boards cost $105,827. Producers and distributors paid $125,620, and exhibitors $114,560, during the year. Cash on hand Dec. 31 last was $36,293.

Chicago Scale Talks

Chicago scale negotiations are now proceeding. Union reported to be asking for 20% increase, the theatres countering with request for *duplication of tentative New York City arrangement where basic hourly rate is based on seating capacity and admission price.*

No trouble in reaching a mutually satisfactory agreement is anticipated.

Proposed New York City Projection Scales

SEATING CAPACITY	ADMISSION PRICES 25c and under	30c	35c	40c and over
400— 599	$.75	$.85	$.90	$1.00
600— 799	1.00	1.10	1.15	1.25
800— 999	1.25	1.35	1.40	1.50
1,000—1,199	1.50	1.60	1.65	1.75
1,200—1,399	1.75	1.85	1.90	2.00
1,400—1,599	2.00	2.10	2.15	2.25
1,600—1,799	2.25	2.35	2.40	2.50
1,800—1,999	2.50	2.60	2.65	2.75
2,000—2,199	2.75	2.85	2.90	3.00
2,200—2,399	3.00	3.10	3.15	3.25
2,400—2,599	3.25	3.35	3.40	3.50
2,600—2,799	3.50	3.60	3.65	3.75
2,800—2,999	3.75	3.85	3.90	4.00
3,000—3,199	4.00	4.10	4.15	4.25
3,200—3,399	4.25	4.35	4.40	4.50
3,400—3,599	4.50	4.60	4.65	4.75
3,600—3,799	4.75	4.85	4.90	5.00
3,800—3,999	5.00	5.10	5.15	5.25

Over 4.000—$6.00 an hour.

(a) The figures shown are the rate per hour that the theatre is in operation. No operator shall work more than 30 hours per week.

(b) Where booth cost October 1st, 1934, is less than $60.00 per booth per week, the minimum booth cost shall be $60.00 per week.

(c) Exceptions may be made by an arbitrator or arbitration board, be provided for collectively.

(d) Where booth cost October 1st, 1934, is reduced, no reduction shall be greater than 33 1/3 per cent per week.

(e) The proposed schedule shall exist for a period of 10 years subject to collective revision at stated intervals, the first revision to be not sooner than 2 years from the date of enactment.

NEW EQUIPMENT

A summary of the latest developments and improvements in the projection field

PROJECTOR carbons constitute one of the most important expense items in the theatre—an expense, incidentally, to which no valid objection can be made, provided the full length of carbon supplied by the manufacturer could be utilized. And therein hangs a tale—a story, that is, and not the tail end of the carbon which will be discussed herein.

Substantial economies in carbon costs are possible through the use of a carbon saver, several of which have been marketed to date but none of which has proved satisfactory, due either to faulty design or difficulty in handling. Excessive carbon costs still is an acute problem, however, and one that merits the wholehearted cooperation of the field.

At present the limitations of the projection equipment make it necessary to discard carbon stubs of at least 4 inches in length. However, projectionists are unwilling to assume the risk of running so closely to the minimum stub, thus very often the discarded stubs run to 6 inches and even more. This results in great waste and excessive costs.

No Drilling, Reaming, Threading

There has been made available recently a carbon saver of new design and utilizing a new principle which, after extensive tests under actual operating conditions, can be recommended as entirely practical and capable of overcoming all previous objections to such devices. This new Saver, for use with 7 mm. Suprex carbons and also with the 9 mm. high-intensity carbons, is unlike all previous similar devices in that it requires no drilling, no reaming or threading of carbons, all of which involve a degree of wear and consequent replacement of parts, in addition to considerable trouble in handling.

The Saver, detailed in the accompanying drawing, is handled as follows: A hollow wooden handle is provided into which is dropped a metal cap, used on each carbon. The unburned end of the carbon stub is inserted into the handle and held against the cap. The entire assembly is then inverted, and the end of the carbon is struck sharply against a solid object to force the cap onto the carbon.

The capped carbon is then removed from the handle and is secured in a metal extension holder by means of a knurled thumb screw. It is then ready for use. The complete operation requires only a few seconds, and creates no dust or dirt. It demands of the projectionist a very minimum of effort. The method of attaching the cap to the carbon and setting up in the extension holder assures a perfect alignment of carbons. A further advantage is that the same end of the carbon is burned throughout, making it unnecessary to form a new crater in the carbon.

Tests show that it is safe to burn the stubs to within an inch of the metal cap, compared with the stub of six inches or more now being discarded.

The savings possible with this new carbon saver are impressive: With the 9 mm. carbon there is realized a saving of at least 3¾ inches of carbon, or an additional burning time of 21 minutes. At prevailing carbon prices, the expense of the 9 mm. carbon is reduced from 15 to 12 cents per hour of operation. (This computation allows for the cost of the metal cap used on each carbon.) Savings on the Suprex carbons are correspondingly high.

Additional savings may be realized by having the projectionist check the burning rate of the carbons, at correct current level, and making a note of the consumption in a definite period of time. This will enable him to know the exact length of carbon stub required for each of the reels, according to their running time. The projectionist should also make a note of the time required for the arc to become stable after striking. The second arc should not be struck, naturally, before necessary, the time being based on the foregoing estimate.

This Saver is manufactured by the Projector Improvement Company, Chrysler Building, New York City.

BALDOR ANNOUNCES NEW 25-60 RECTIFIER

THE Baldor Electric Company, of St. Louis, Mo., announces the development of a 60 ampere rectifier which is specially designed to supply current for the new Suprex carbon arc lamps. Its complete rating is as follows: 25-60 amperes, 30-40 D. C. volts.

The voltage range of 30 to 40 volts is for the Suprex carbons; while the extra voltage tap of 55 D. C. volts is to supply current to low-intensity carbon arc lamps.

In line with recent recommendations, the "Handy" rectifier will be supplied for operation from a three-phase, 60-cycle A. C. circuit. It cannot be operated from a single-phase circuit.

REFLECTOR SHIELDS ENDORSED BY I. P.

VICIOUS and misleading propaganda relative to the worth of the new Reflector Shields introduced recently continues to be disseminated throughout the projection field. Those opposed to the use of the Shields (formerly known as Mir-O-Guards) have "invented" a list of objections to their use, particularly with respect to their alleged "tremendous light loss" and "excessive cost."

Relative to the "tremendous light loss," it should be remembered that these Shields were subjected to careful tests by members of the Practical Projection Committee of the S. M. P. E., the members of which rank high in projection circles and undoubtedly know more about projection than those who now criticize the Shields; that the report of the Committee was presented before a crowded convention session and, just prior to its almost unanimous acceptance by the Society, was subjected to a searching inquiry by leading lamp manufac-

(*Continued on second page following*)

FIGURE I

Drop Cap (a), then carbon stub (b), into capping-tool (c)

FIGURE II

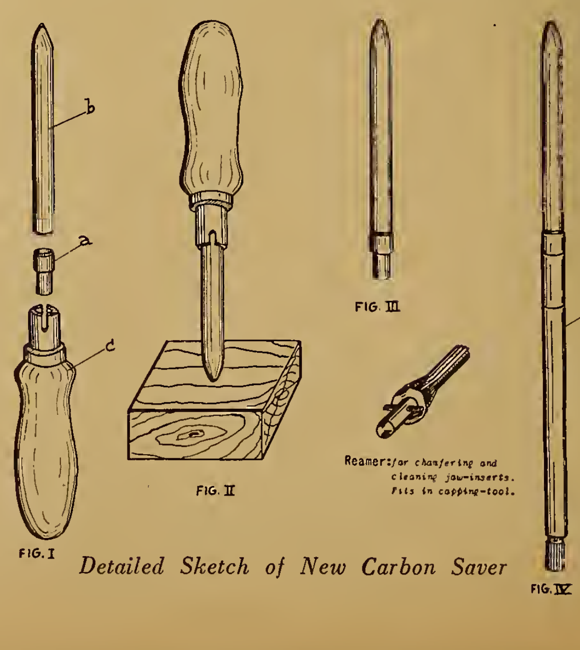
Hold upside down against block of soft wood, and tap lightly on top with hammer

FIGURE III

Remove carbon-stub with cap attached

FIGURE IV

Screw up tightly in holder (d)



Detailed Sketch of New Carbon Saver

Reader Interest?

Certainly—and

READER LOYALTY, TOO!

Within the last two months I. P. circulation (direct paid to the publisher—no agents, no premiums) has increased by 11%—while in the same period advertising in I. P. has increased by 28%.

I. P. is certainly going places and doing things in the projection field. And why not? I. P. is always first with the latest news of projection technique and equipment, always jealously guards high projection standards and vigorously resists any threat to craft welfare.

And I. P. always takes a definite stand on controversial topics: in its pages you will never see half-hearted and wishy-washy discussion of vital topics.

That's why I. P. can offer to advertisers more than reader interest; that's why it can and does offer reader loyalty, too—an indispensable factor in complete acceptance of products advertised in I. P.'s pages.

Within the last two months I. P. has been cleaning up the projection field as far as circulation is concerned. I. P. circulation is unique in that it is entirely a direct full-paid cash business: not a nickel of I. P. subscription money goes to agents or for premiums—the only industry paper with this type of voluntary clean-cut circulation. Consider this nice clean, cash circulation within the last two months:

Local Union	*Amount*
Westchester, N. Y.	48
Tulsa, Okla.	8
Syracuse, N. Y.	45
Long Beach, Calif.	36
Rock Island, Ill.	7
Sioux Falls, S. D.	8
Cheyenne, Wyo.	9
Sioux City, Iowa	11
Port Arthur, Tex.	14
Hamilton, Canada	13
Logansport, Ind.	15
Worcester, Mass.	47
Cedar Rapids, Ia.	9
Springfield, Mo.	10
Jacksonville, Fla.	11
San Bernadino, Calif.	18
Hartford, Conn.	38
Okla. City, Okla.	10
Ponca City, Okla.	7
Springfield, Mass.	22
Bridgeport, Conn.	39
Total	425

And these are only the bulk orders direct from organizations, most of them for a two-year period. Space limitations do not permit reprinting the "raves" for I. P. that accompanied these orders. Why, Worcester, Mass., even included some stagehands—if you can tie that one.

There were a host of smaller bulk orders, too, in addition to innumerable individual orders. Even the U. S. Army succumbed to I. P.'s quality appeal and ordered copies for all its motion picture posts as their first lines of defense.

And so it is that I. P. dominates the projection field—in circulation and in advertising, or any way you please. Of course, it earned this high position by serving the craft well, by serving up the finest technical articles, by serving up the facts, bereft of hooey, on any controversial topic, and by digging in and fighting like Hell when danger threatened the art or the craft.

I. P. carries more than four times the projection equipment advertising carried by any other industry publication—naturally.

INTERNATIONAL PROJECTIONIST

580 Fifth Ave. New York, N. Y.

Ip

turers, projection specialists and optical men, and that the latter group endorsed the Shield and riddled the "light loss" contention.

Negligible Light Loss

As a matter of fact, the light loss occasioned by these Shields is so small as to be negligible, being less than 1% and impossible to gauge accurately with the finest of measuring instruments.

On the score of "excessive costs," it is apparent that a Shield, costing the theatre less than $4, is a much better proposition than a new mirror, having to be replaced every few months, at a cost ranging anywhere from $8 to $25. The answer to the assertion that mirrors are not replaced "every few months" is that they should be.

PROJECTION RISES TO NEW HEIGHTS IN FIRST AIRPLANE MOVIE SHOW

PROJECTION rose to new heights, so to speak, during the month when for the first time anywhere a motion picture show was given within an airplane in flight 12,000 feet over New York City. The showing was part of an exploitation stunt in behalf of the new Martin Johnson picture "Baboona," jungle thriller shortly to be released.

The Douglas plane with which Captain Eddie Rickenbacker recently set a new transcontinental transport record was utilized for the stunt, each flight of which saw aboard many distinguished public personages and reporters for the trade and daily newspaper press.

Of particular interest here is the projection equipment installation, the setup for which is shown in the accompanying illustration. A completely all-A. C. operated Simplex Portable Sound, employing a Mazda, was used, together with a rotary converter for the A. C. Ten 12-volt storage batteries supplied the power. The picture was 3 x 4 feet.

Each flight lasted an hour, with 3 reels being shown each time during the latter portion of each trip. The entire installation was supervised by Messrs. Herbert Griffin and Henry Heidegger of the International Projector Corp.

"The quality of the picture was surprisingly good," said Mr. Griffin. "Originally we planned to climb to 12,000 feet and then, after cutting the motors, glide to a landing, so that the sound would not be affected by the roar of the motors. We estimated that the glide could be stretched out to nearly half an hour, permitting the showing of 3 reels.

"Our first trip changed this plan, however, for we found that the perfectly soundproof cabin permitted excellent results, even with the motors roaring away." (Ed.'s Note: This soundproofing job was done by Sperry-Gyroscope, well known in the picture industry through their arc patents.)

"The picture was fine—really splendid, and so steady and clear that every word of the sound could be heard. Interestingly, one point in the picture has a sudden 'pan' where the camera follows a leaping tiger at a sharp angle, and so realistic is the shot that all the passengers on every trip got a sudden impression of the plane turning sharply at a 90-degree angle and instinctively grabbed for their seats. Yes, there were many sheepish expressions on view when they realized their mistake."

Said Martin Johnson in a letter to Mr. Griffin:

"I appreciate tremendously your efforts in helping us to put over last night's unique showing of 'Baboona.' For the first time sound pictures have ever been shown in an airplane, and in the face of many mechanical difficulties, the results surprised me.

"The picture was fine and cleancut, and the steadiness of the image is a tribute to that marvelous Simplex of yours. One could hear every little bird sound; in fact, I think our air show was better than that in the projection room when we were editing the film.

"Your Simplex is so wonderful that I'd like to have everybody know about it."

FIRST AERIAL SOUND MOVIE SHOW

Showing complete sound picture projection installation in tight quarters. Fine technical results attained in series of flights 12,000 feet over New York City

James J. Shaughnessy

JAMES J. SHAUGHNESSY, president of Local 650, Westchester County, N. Y., died on January 12 when peritonitis set in after an acute attack of appendicitis.

Shaughnessy ("Jim" to his thousands of friends within and without Labor circles), at 36 was one of the youngest Local leaders in the Alliance, having headed Local 650 since its formation in 1927. It isn't necessary to say that Jim Shaughnessy was one of the greatest Labor leaders, nor that Westchester County isn't among the largest cities in America. But it is important to say that Westchester, despite its close proximity to the Labor cesspool that is New York, and having within its borders Union theatres owned by the same people who operated non-union theatres in New York, has always been and still is 100% Union.

This, after all, is the true mark of Jim Shaughnessy's worth—the fact that in his particular job he was a champion. Having nursed Local 650 along since it was only a baby Local, Jim Shaughnessy needs no other monument; the enduring success of "his baby" will mark him apart from others less capable.

And Jim was a man, too—a man's man, as was attested to by the vast congregation of important personages from all walks of life who gathered to pay their last respects. These puny lines could never convey just how much of a man Jim was. It's Hell to have to write them . . . and still there's something swell in harking back to the grand person that was Jim Shaughnessy.—J. J. F.

L. U. 245 ANNUAL BANQUET

Local 245 held its annual banquet on Jan. 6 at the Hotel Edison in Lynn, Mass. Present at the affair, in addition to the membership, were local officials, city and district exhibitor managers, sound company representatives, I. A. officials and a limited number of invited guests.

The principal speaker was James J. Finn, editor of International Projectionist, who observed with satisfaction the presence at the affair of managers for the first time and who made a strong plea for closer employer-employee

cooperation. Mr. Finn detailed several new technical developments which aid in putting on a better show. He characterized sound system servicing as "nothing less than a racket" and urged projectionists to assume jurisdiction over this type of work.

BARROWS, BURKE RE-ELECTED, FORMER FOR 18th TERM

Thad C. Barrows and James F. Burke were elected president and business representative, respectively, of Boston Local 182 in a recent election. These two men have served the Local for many years, with Barrows now entering upon his 18th consecutive term. Other officers are: Bernard McGaffigan, vice-president; Al Moulton, financial secretary, and Joe Rosen, treasurer.

Named to the executive board were Maurice Addleson, Louis Pirovano and Joseph Nuzzolo.

NEW VISTAS IN SOUND TRANSMISSION

(*Continued from page* 22)

only one of the elements that can distort in broadcasting.

(C) *Receiving equipment.* For perfect reception we should need a loud speaker that would respond with equal sensitivity from about 30 to 13,000 cycles per second. All the receiving sets that do not have such a speaker cannot help distorting the music.

Adequate transmission of music must meet three requirements: it must faithfully transmit (1) the complete frequency range; (2) the complete intensity range; and (3) with the true auditory perspective.

The fundamental principles of radio are a mystery that we may never fully understand. The greater the scientist, the more clearly he realizes and the more frankly he tells us how little he knows. As we learn, we become more aware of our ignorance. But radio process can be outlined in simple terms. If you talk over the radio, the sound of your voice is picked up by a microphone, transformed into electrical energy, amplified, carried by wire to a transmitter, sent out into space as radio frequencies—or Hertzian waves,—picked up by receiving equipment, transformed into electrical energy, amplified, sent out by the loud speaker as sound or audio-frequencies reproducing your voice. Briefly stated, this is the general process for the transmission of either speech or music.

In a parallel sense, but on another plane, we know the circuit that music follows—from inspiration, through transmission (composer and interpreter) and reception (music lover), back to inspiration. The important question is the degree of faithfulness with which symphonic and operatic music can be delivered in our homes, and the message conveyed in its full value.

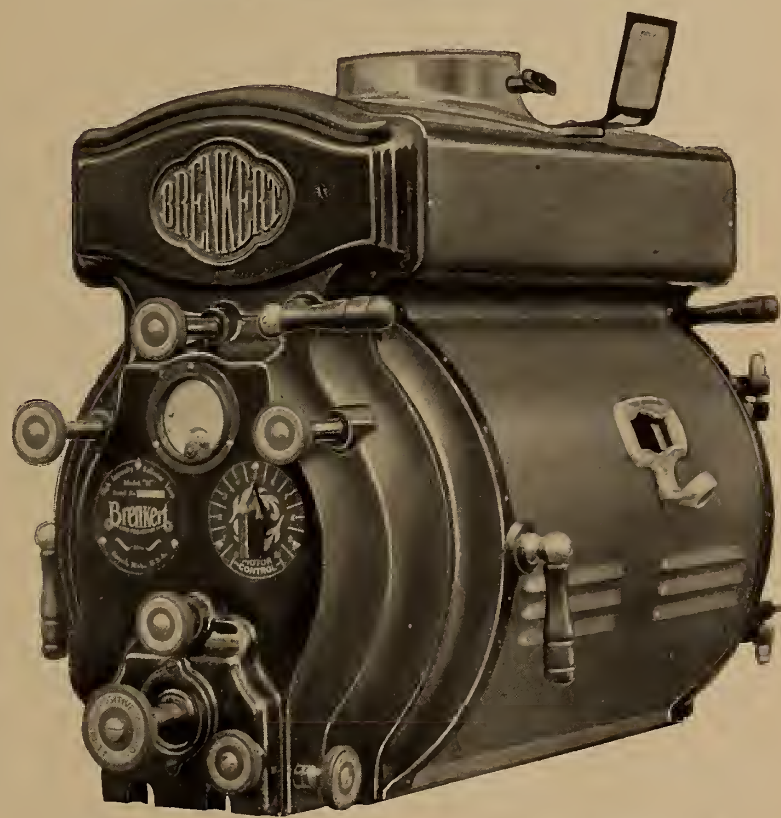
At present these types of music come

The New

BRENKERT "H"

High-Intensity Reflector Arc Lamp for D. C. Suprex Carbon Operation

—is proving a revelation in screen results and low operating costs throughout the country



- Wide range feed regulation with separate negative feed adjustment permits operating this lamp at 34 to 65 amperes with positive Suprex carbons of 6-mm., 7-mm., and 8-mm. diameter.
- This is the widest range yet accomplished and permits a proper screen intensity to meet requirements of various size theatres with a range of operating costs to suit your pocketbook.
- Rugged construction and accurate, dependable operation assures complete satisfaction.

A Brenkert product throughout, which means a guarantee of perfect projection

See the Brenkert distributor or write direct for literature to

BRENKERT LIGHT PROJECTION CO.

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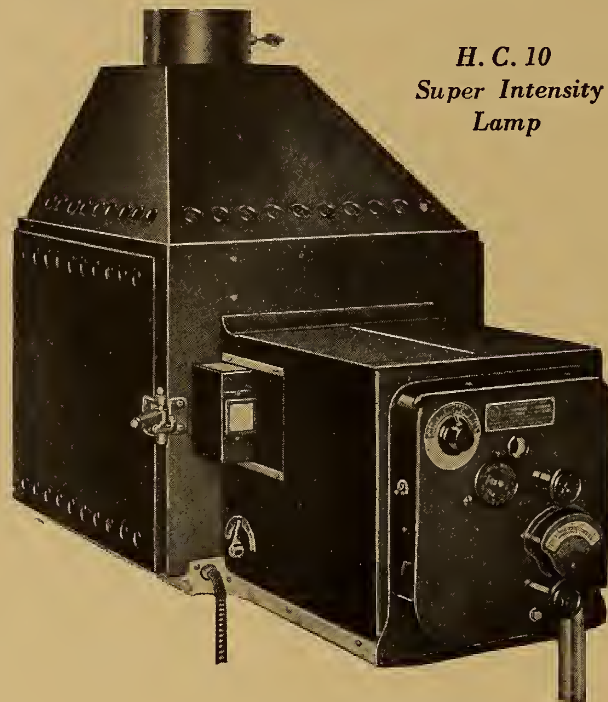
7348 St. Aubin Ave. Detroit, Mich.

H&C Inc.

SUPER INTENSITY

AUTOMATIC PROJECTION LAMP

H. C. 10 Super Intensity Lamp



The

Lamp With Accurate Arc Regulation and Arc Focusing by Means of the Heat From the Arc Itself

H. C. 10 Features:

- Self-Starting
- Self-Focusing
- Independent Negative Feed Regulation
- Magnetic Stabilization
- Better Arc
- Self-Lubricating Bearings
- Standard Ammeter
- Carbon Indicator
- Forced Air Cooling
- Correctly Shaped Hood
- No Feed Rollers
- Full 22-inch Trim

Descriptive booklet on request. Write for it to

HALL & CONNOLLY, Inc.

24 Vandam St. New York, N. Y.

from the radio in incomplete and changed form. The scientific explanation can be simply stated. The character or quality of tone in music is mainly due to harmonics or overtones. At present, many of these cannot be and are not transmitted and received by radio. The result is that such sounds as the muted trumpet or the oboe cannot be transmitted and received faithfully, and therefore frequently come to us in changed or distorted form.

Harmonics and Timbre

Harmonics or overtones are most easily explained by an example: If you sing a note, you probably hear only that single note, which musicians call the fundamental. Above that, however, is also sounding the octave, usually less loud. And above the octave is sounding another soft tone five notes higher. And another, four notes higher still. And another three notes higher still. And so on. These are the overtones or harmonics and they have simple ratios of vibrations or frequencies or cycles to the fundamental tone. To every single vibration of the fundamental tone the first overtone has two vibrations, the second overtone three vibrations, the third overtone four vibrations, and so on.

The relative loudness of the harmonics to each other and to the fundamental is the cause of the quality or timbre or tone-color of a tone. For example, if the high harmonics are louder than the low harmonics and the fundamental, the tone-color produced will be thin and piercing and reedy, like the oboe or muted trumpet or the gamba or reeds of an organ. But if the low harmonics and the fundamental are louder than the high harmonics, the resulting tone will be round and full, like a flute, or a horn played softly in the middle register, or the diapason of an organ.

Requisite Frequency Range

The adequate transmission of the harmonics in operatic and orchestral music includes frequencies or vibrations as rapid as 13,000 per second. By frequency is meant roughly what musicians call "pitch"—whether a tone or group of tones is high or low or in the middle register. For example, if you sit at the piano, the notes immediately in front of you or in the center of the keyboard are in the middle register, those to your right hand in the high register, those to your left hand in the low register. In much the same way, the engineer and physicist speaks of high, middle, and low frequencies or periodicities or cycles. He measures them in time so that the "A" to which the violinist tunes his instrument has 440 cycles per second.

These frequencies can be thought of as alternate condensation and rarefaction of air—as a series of pressures. For the purpose of this writing, differences of frequency or pitch can be thought of as the contrasting sounds of the high tones of a flute or violin, as examples of high frequency; the mellow sounds of a cello or the lower sounds of a contralto voice, as examples of middle frequency; and the deep sounds of an organ pedal or of

the double bass, as typical low frequencies.

Instead of the 13,000 frequencies per second which are necessary for the adequate transmission of orchestral music, radio listeners in most of the homes in this country are hearing, at present, up to about 5,000 frequencies or vibrations per second and sometimes fewer. That part of the music which should be conveyed from 5,000 to 13,000 frequencies is obviously lost.

The 13,000 frequencies I have mentioned is not a figure set arbitrarily. It results from very close and exact tests, which were made by Dr. Harvey Fletcher, head of the Bell Telephone Laboratories and a group of assistants, of which I was one. These tests were made on a mixed group composed of engineers, musicians, amateurs, and others. Our aim was to see up to what periodicity it was essential to be able to transmit sound in order faithfully to broadcast good music for the average ear. We began, of course, with full realization that the response of ears is infinitely varied.

Ear Response Differs

It is not too much to say that everyone's ear response differs at least in some slight degree from that of his neighbor. Some of us hear up to 20,000 frequencies per second. Some up to only 12,000. The average capacity is perhaps about 15,000. Our tests convinced us that, for the average ear, up to at least 13,000 is really necessary, and that fewer than that will not carry orchestral and operatic music with complete faithfulness.

The first step toward making it possible to include the missing vibrations between 5,000 and 13,000 is, in my opinion, to widen the channels that were apportioned some years ago by the Radio Commission. At present these channels are so narrow that the full frequency range necessary for the complete and undistorted broadcasting of good music is practically impossible.

Of all the available frequencies for such forms of communication as wireless telegraphy and telephony, distress and other shipping signals, and the radio we know for the sending out of music, lectures, speeches, etc., only a part is allotted to the radio we use—and this must

NOW AVAILABLE IN ALL SIZES!

REFLECTOR SHIELDS

[Formerly Mir-O-Guards—Patent Pending]

Cut Your Reflector Costs 75%

——*and improve projection*

All Sizes Now Ready

Type	*Diameter*	*Type of Projector*
PL	7⅝	Peerless Low
PHL	11½	Peerless Hi-Low
PDC	14	Peerless Magnarc
ADC	9	Ashcraft DC
MDC	10¼	Morelite DC
SL	8	Strong Low
SHL	12	Strong Hi-Low
SDC	10	Strong DC
BHL	12	Brenkert Hi-Low
BDC	10	Brenkert DC

Stop buying reflectors every few months. Use Reflector Shields—the perfect protector. These Shields are of crystal clear, heat-resisting glass, having the identical curvature of, and fitting perfectly over, the reflector.

Reflector Shields keep your reflector always new. No more pitting, no more dirt and grime, no more cracked reflectors—for the Shield protects the mirror and bears the brunt of the constant attacks of pitting and dirt.

The Shield is very inexpensive and permits enormous savings in reflector costs. You can afford to always have these Shields on hand; you can buy them in sets—perfectly suited to your particular type of reflector. Reflector life is prolonged indefinitely with this sensational projection aid. Just slip a Shield in front of your reflector—and then forget it. Months later you need only slip out the Shield and replace it with another. Just one minute and the job is done. And your mirror still is NEW!

Extensive tests prove that these Shields actually aid projection by offering constantly a good reflecting surface. There is no light loss with this Shield; the endorsements of leading projectionists everywhere prove its quality.

Tell your theatre manager or owner today about this sensational new projection aid that cuts reflector costs by 75% and improves projection. If your dealer cannot supply you, write to us direct—today!

Reflector Shields are sold only through dealers. Inquiries are invited from reputable dealers everywhere.

?

Why spend from $15 to $30 for a new mirror every few months, when by using these Shields you can have perfect projection always for the comparatively inexpensive sum of from $3.95 to $5.50, depending upon the size of your reflector?

Prominent projectionists everywhere recommend the use of Reflector Shields for efficiency and economy.

REFLECTOR SHIELD CO.

235 Fourth Ave. **New York, N. Y.**

Cooperation

with Labor and Exhibitors

THROUGH INDIVIDUAL OWNERSHIP

Members of the Independent Theatre Supply Dealers Association cooperate with Labor and exhibitors on the basis of individual ownership. The Independent dealer has a vital interest in the welfare of Labor and the progress of the exhibitor, and to these groups he extends the utmost cooperation.

No long-distance servicing plans for Independent dealers, who are local men interested in local welfare. They are alive and alert to your needs at anytime of the day or night. Independent dealers offer the best merchandise obtainable—the product of individually-owned and operated factories.

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Patronize Independent Supply Dealers Association members and further the cause of a free and open market for supplies — and Labor

INDEPENDENT THEATRE SUPPLY DEALERS ASSOCIATION

Executive Offices: Paramount Bldg., New York, N. Y.

Your Preference —Please

We solicit your aid, Mr. Reader, to the end that *International Projectionist* may render the maximum service to its readers. You can help to improve this service by stating your preference for editorial matter.

What type of articles, drawings, photographs and features do you prefer? Use the space below to record these preferences. We'll do the rest.

USE THIS FORM

Editor, INTERNATIONAL PROJECTIONIST
Sir: I should like to have published in INTERNATIONAL PROJECTIONIST articles (or drawings) relating to the following subjects:

1. ....

2. ....

3. ....

4. ....

Name ....

Address ....

be subdivided so as to give each of the transmission stations of this part of the world a channel that will not interfere with adjacent transmitters. There has been a great demand for these channels, and in order to supply this demand the channels have been made narrow. These narrow channels do not permit the necessary frequency range of about 30 to 13,000 cycles per second, but up to only about 5,000.

The first and fundamental need is for Washington to revise its allotment of channels so that they can be broader.

The second step is for transmission stations to send out music with an equal response from about 30 to 13,000 frequencies per second. The more progressive transmission stations are eager to do this. In thus enlarging the frequency range of transmission of music no harm will be done to the broadcasting of the voice. On the contrary, brilliant voices need high harmonics for complete transmission of singing, and even speaking voices need high harmonics for sibilants. Enlarging the frequency range need not interfere with short-wave transmission which gives us a wider radius of effective reception. Short-wave and wider frequency range are two different subjects—not necessarily interfering with each other.

Present Sets Inadequate

The third step is for the makers of receiving sets to design sets that can receive and give out to the listener with an equal sensitivity of response from about 30 to 13,000 cycles per second. Some of the makers of receiving sets are only waiting for Washington to enlarge the channels before they too enlarge the receiving range of their sets.

These three steps will involve temporary practical difficulties. I am told that, from a commercial point of view, these difficulties are not to be disposed of lightly, but that the farsighted manufacturer will see that a satisfied and expanding radio public is his real objective and is the permanent security of his own commercial interests.

From the standpoint of a musician and radio enthusiast, it seems to me that if music can be broadcast more faithfully by employing the latest scientific discoveries, and if the net result of employing these is not only raising the quality of musical sound but also increasing the number of eager and appreciative listeners from coast to coast, then the changes necessary, and the discarding and replacing of a considerable amount of present equipment, can only be regarded as a secondary consideration. In any case radio equipment is wearing out and being replaced all the time, with the situation as it now is.

Technical Difficulties

There are also certain technical difficulties, for which there may be more than one solution. In offering my own suggestions as to how these problems can be dealt with, I have well in mind that there is more than one way of doing most things. The ideas I am presenting here

will, I hope, invite the attention of physicists, radio engineers and the public to the problem of *what music needs*, and invite consideration not only of my own proposals, but of alternative proposals which experts in various fields have made or may make.

Fewer, Wider Channels

One way of widening the channels might be to zone the country and to apportion wider channels in such a way that the same channel could be used for a number of zones, so spaced out that they would not overlap and interfere. This would mean fewer channels, wider channels, and intelligent organization of the whole country for radio. All this is possible. Each zone using the same wide channel could broadcast a different program at the same time. Or some or all of the zones using the same channel could broadcast the same programmes by wiring the stations together. But this wiring system would have to be of high quality. Ordinary telephone wiring systems adequate for speech would not be suitable for music. This kind of zoning might mean that transmission stations would have to adjust their power in order to prevent interference between those zones which would be using the same channel. Obviously, there would be, for a time, some inconvenience to the transmission stations in a general requirement to readjust their power. The ultimate result, however, would be a gain to all radio listeners, who would, by this revision or some other plan achieving the same result, be able to hear music and speech in complete and undistorted and satisfying artistic form.

What the musician calls loudness and softness, the physicist calls intensity. He measures intensity by units called decibels. Good music needs, in an opera house or concert hall, an intensity range of about 85 decibels. That is to say that, from the softest sounds of an orchestra or operatic ensemble to the utmost sonorities of a great *tutti*, there is and should be a very wide range or difference.

There are physical, psychological, and musical reasons for this. Much of the emotional effect on us of music and its dy-

The Rectifier You Have Been Waiting For

THE NEW **"HANDY"** FOR SUPREX CARBON ARC LAMPS

25-60 AMPERES — 30-40 D.C. VOLTS

WITH ADDITIONAL VOLTAGE TAP TO SUPPLY 55 D.C. VOLTS

CAN BE OPERATED FROM THREE PHASE, 220 VOLT, 60 CYCLE, A.C. CIRCUIT

$160.00 LESS AMMETER
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Write for Full Particulars

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"HANDY" MOTION PICTURE RECTIFIER

For Low Intensity Reflector Arc Lamps

$72.00 LESS AMMETER
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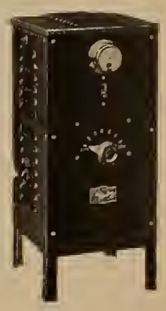

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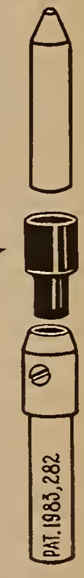

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namic intensity of mood and expression depend on gradual or quick increase of loudness (*crescendo*) and gradual or quick reduction of loudness (*diminuendo*). Also sudden accents on one or more notes, or on a chord, or on a melodic outline, either on the top edge, or the lower edge, or somewhere in the middle of the total mass of sound, add at certain moments to the poignancy of the music. Another factor in increasing the eloquence of some kinds of musical expression is the powerful contrast of a great mass of loud harmony followed or preceded by delicate, distant-sounding music.

One of the greatest values of music—its power to evoke in us moods and states of feeling and of being—thus depends greatly upon dynamic contrast and gradation. Of course the potential intensity range of an orchestra or operatic ensemble varies in different concert halls, opera houses, and radio studios. Some of the influencing factors are the texture of reflecting surfaces, the degree of rigidity of the structure to which these surface materials are attached, the size and form of the total air-volume that is vibrating, the rapidity of absorption at various frequency levels, the general reverberation period of the enclosed space, and so forth.

For example, the Centre Theatre in Radio City gives—to one conducting in it—the impression of an almost limitless intensity range. Some other halls have so narrow a potential range that music in them sounds monotonous and relatively colorless. Every orchestra varies in intensity range, and even the same orchestra varies with different conductors, for psychological reasons which I am far from fully understanding.

Today in broadcasting a symphony orchestra, we are employing an intensity range of about 30 decibels, instead of the 85 decibels that we are using in our concert playing in performing, for instance, music with the immense dynamic range of Wagner. In broadcasting, the 85 decibels have to be compressed to about 30, and this is usually done by the engineer at the controls.

The control engineer has certain instruments before him, one of which is like the volume control on your radio set. By turning it one way he gives the music the full intensity that is the result of amplification. By turning it progressively in the opposite direction he gradually attenuates or softens the sound of the music. By reducing the loud moments and by increasing the soft parts he compresses the intensity range so that there will be no overloading by loud music and so that the soft music will be easily audible and not covered by the "noise level," which is the sum of all the extraneous sound produced by the transmission and receiving equipment, plus audience noise, if an audience is present, as in a concert.

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than might be imagined. The total sound of several thousand persons turning the pages of the programme book, making other movements, talking or whispering, coughing, the sound of late comers finding their seats, of the opening and closing of doors, is surprisingly high.

The controlling and compressing of the intensity range can also be done by the conductor, who can make the soft passages louder and the loud passages softer, but this devitalizes the music.

For the reception of operatic and symphonic music in the average home, a dynamic range of 85 decibles would not be necessary, but music needs a much greater variation of loudness and softness than is at present possible.

Auditory Perspective

When we listen to music in the opera house or concert hall the complex mass of sonority enters our two ears from the front, both directly and by reflection, and from the sides and back by reflection only. Our impression is that the major part of what we hear is direct and the lesser part reflected.

But the truth is the reverse. The reflected sound in most theatres and halls is very rich and full, and is greater than the directly heard sound. Although we may not be conscious of it, our two ears are hearing slightly different sound-patterns because the reflections from right and left are different in time and in the intensity of all the component parts of the complex sound-mass. Unconsciously we compare these different impressions received from right to left and this comparison gives us the sense of perspective—of a feeling of tonal spaciousness. More of this subject will be included in that part of this writing that deals with "wired transmission."

The microphone is a kind of electric ear. In broadcasting, the microphone picks up the sound which is afterward brought by a complicated process to our ears. But the microphone is a *single* ear attached to a *single* circuit or means of carrying the sound to us. To convey music with full and true auditory perspective, we should have, in my opinion, double circuits which could be made to correspond to our method of hearing with two ears and which would give us the tonal spaciousness and beauty of sound that make music so satisfying in a large and well-planned auditorium.

When all the results outlined in (1) Frequency Range, (2) Intensity Range, (3) Auditory Perspective, are brought about, it will be more possible to find the answers to the two great questions of how the cost of radio can best be met and what ought to be the relation of government to radio. First of all we must see clearly what we *need* from radio socially and technically.

(To be Continued)

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SOMETHING FOR NOTHING: HOW MUCH WILL IT COST?

(*Continued from page* 10)

sound and against which so much criticism has been directed.

Outside of making inspection of theatres or any department thereof, it will be necessary for the "electrics" to continuously make laboratory tests of various pieces of equipment and compile data so that the proper recommendations and specifications may be drawn. This will cost considerable money. Where is this money to come from?

The R. & R. Contract

The R & R (repair and replacement) Plan whereby maintenance and service may be had for a fixed charge was only developed after a great deal of opposition to the previous plan and prices of parts forced a change in policy.

True, the independent dealers do not possess elaborately-equipped research laboratories and do not have the time to play around with high-sounding theory. They merely happen to know the equipment and supply business from "A to Z" from a practical standpoint, which can only be acquired by actual experience and contact. They have always given to the exhibitors the kind of service that is most needed and appreciated in the many emergencies which crop up daily in the operation of the theatre.

Is it not only fair, in that case, but also good business for the exhibitors to give their patronage to these well-trained and helpful members of the trade? Frankly, we believe that it is and that it would be a very good thing for the projectionist to overlook no opportunity to impress this upon theatre owners.

We must repeat that the most careful thought does not enable us to understand just how "something can be had for nothing." Possibly, our theoretical training has not been adequate to give us the solution to that problem, thus we must conclude that there is dirty weather ahead. That being the case, it is a certainty that the interests of dealers, manufacturers, exhibitors and Labor are threatened, the interests of these groups being very closely allied.

The dealers know that they cannot compete with the unlimited resources of the powerful combines mentioned here and in Mr. Finn's previous article. Consequently, they feel that the fight must be carried along other lines and will not hesitate to invoke the protection of the Government in the knowledge that we still have legislation designed to hold monopolistic activities in check and to suppress any attempts to ban free competition through the use of practices in restraint of trade.

Possibly big business, as exemplified by the "electrics," is turning philanthropic, but then what is the meaning of the following excerpt from a letter from one of our members:

"Recently on a job at E. Millinocket, Maine, we were installing complete equipment, except for sound. We had secured the contract including sound screen which was later cancelled by our customer because ERPI has a considerable number of users of their equipment in this territory who are operating under the so-called R & R Plan."

To insure the distributors of a uniform quality and through this source, the buyers, our organization contemplates establishing test procedure and having all merchandise submitted to a pactical test prior to its sale.

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The dealers will go to the limit in their efforts to stay in business and to that end urge the cooperation of all other interested parties — namely, manufacturers, exhibitors—and Labor.

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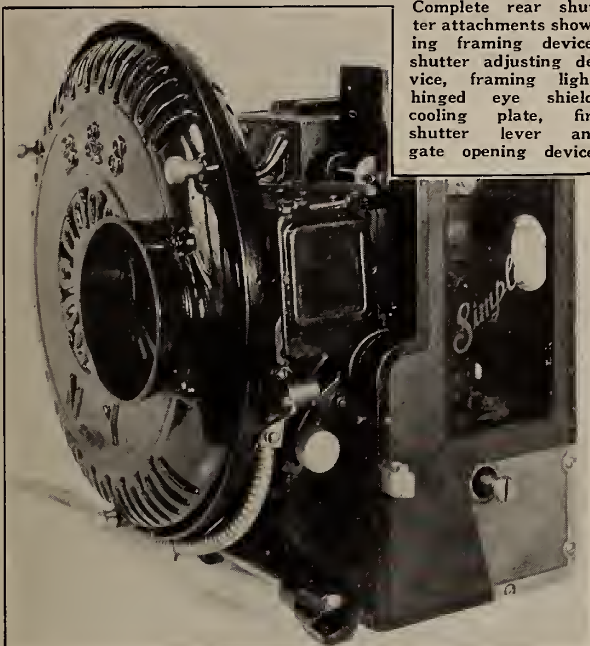

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February 1935
Vol. 8 No. 2

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Within the last two months I. P. circulation (direct paid to the publisher—no agents, no premiums) has increased by 11%—while in the same period advertising in I. P. has increased by 28%.

I. P. is certainly going places and doing things in the projection field. And why not? I. P. is always first with the latest news of projection technique and equipment, always jealously guards high projection standards and vigorously resists any threat to craft welfare.

And I. P. always takes a definite stand on controversial topics: in its pages you will never find half-hearted and wishy-washy discussion of vital topics.

That's why I. P. can offer to advertisers more than reader interest; that's why it can and does offer reader loyalty, too—an indispensable factor in complete acceptance of advertised products.

Within the last two months I. P. has been cleaning up the projection field as far as circulation is concerned. I. P. circulation is unique in that it is entirely a direct full-paid cash business: not a nickel of I. P. subscription money goes to agents or for premiums—the only industry paper with this type of voluntary clean-cut circulation. Consider this nice clean, cash circulation within the last two months:

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Tulsa, Okla.	8
Syracuse, N. Y.	45
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Rock Island, Ill.	7
Sioux Falls, S. D.	8
Cheyenne, Wyo.	9
Sioux City, Iowa	11
Port Arthur, Tex.	14
Hamilton, Canada	13
Logansport, Ind.	15
Worcester, Mass.	47
Cedar Rapids, Ia.	9
Springfield, Mo.	10
Jacksonville, Fla.	11
San Bernadino, Calif.	18
Hartford, Conn.	38
Okla. City, Okla.	10
Ponca City, Okla.	7
Springfield, Mass.	22
Bridgeport, Conn.	39
Total	425

And these are only the bulk orders direct from organizations, most of them for a two-year period. Space limitations do not permit reprinting the "raves" for I. P. that accompanied these orders. Why, Worcester, Mass., even included some stagehands—if you can tie that one!

There were a host of smaller bulk orders, too, in addition to innumerable individual orders. Even the U. S. Army succumbed to I. P.'s quality appeal and ordered copies for all its motion picture posts as their first lines of defense.

And so it is that I. P. dominates the projection field—in circulation and in advertising, or any way you please. Of course, it earned this high position by serving the craft well, by serving up the finest technical articles, by serving up the facts, bereft of hooey, on any controversial topic, and by digging in and fighting like Hell when danger threatened the art or the craft.

I. P. carries more than four times the projection equipment advertising carried by any other industry publication . . . . Naturally.

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 8 FEBRUARY 1935 *Number 2*

Monthly Chat 5

Efficient Operation of the Suprex Carbon Arc 7
W. C. Kalb

Step-By-Step Analysis of Sound Reproducing Equipment, VII 10
Aaron Nadell

New Vistas In Sound Transmission, II 12
Leopold Stokowski

Hints on Efficient Low-Intensity Operation 13
Rolf R. Gruning

S.M.P.E. Head Asks Exhibitor Aid in Improving Theatre Reproduction 14

Present Status of Television Is Discussed By Dr. Goldsmith 14

Aluminum Reflecting Surfaces For Projection Work 15
J. D. Edwards

Projectionists Extend Sound System Servicing 17
James J. Finn

I. A. President Browne on Sound System Servicing 17

New Servicing Plan an Old 'Racket' With New Twist 21
J. E. Robin

I. A. Takes Over Local 110 Following Slaying of Maloy 21

News Notes
Technical Hints
Miscellaneous Items

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420

MONTHLY CHAT

WE RATHER fancied that recent issues of this publication had gone far toward dispelling the fears of the craft anent the "overnight development" of television. Not so, it appears. Our mail continues to harp on this question, and a recently concluded extensive road trip proved this to be the first question asked in any gathering of projectionists.

Our good friend and renowned technician, Dr. A. N. Goldsmith, who knows all the answers, states concisely herein just what are the problems confronting television now and for some time in the future. Read it.

ONE of the most pressing projection problems is the tendency to run everything—carbon trims, generators, lamps—right up to the danger line or even beyond its particular rated capacity. Ratings of any projection adjunct are the result of careful testing and experimentation by the manufacturers thereof, and their recommendations should be closely adhered to. Maximum amperages are no guarantee of best results, as has often been proven in this field—apart from the fact that maximum amperages invariably mean minimum equipment life and loads of headaches.

PROJECTIONIST servicing of visual and sound projection equipment is catching on nicely, thank you. A bit of work, a bit of expenditure and the will to be something more than merely a switch-thrower will handsomely reward efforts in this direction.

PRODUCTION schedules for the balance of this year fail to bear out the oft-repeated promise of a vast increase in the number of colored motion pictures. Picture costs are already running away with themselves in straight black-and-white, and the addition of color vastly increases costs, including labor. Such color as is on view these days merely strengthens the impression of this department that there is nothing more satisfying at this date than a well-lighted, expertly turned out black-and-white job.

THE public press is now utilizing its news columns to announce that the NRA is dead. Their current rather timid approach to this topic merely mouths that which any enterprising trade journal with sufficient courage has said repeatedly throughout the past year or more. Extension of the NRA for another two years, as requested of Congress, means only perpetuating the high-handed control of all industry by the big-business code authorities. Enough is enough.

NOTHING as yet from the U. S. Supreme Court by way of a decision on the Tri-Ergon patent tangle. Projection rooms won't be mauled about for another month or so.

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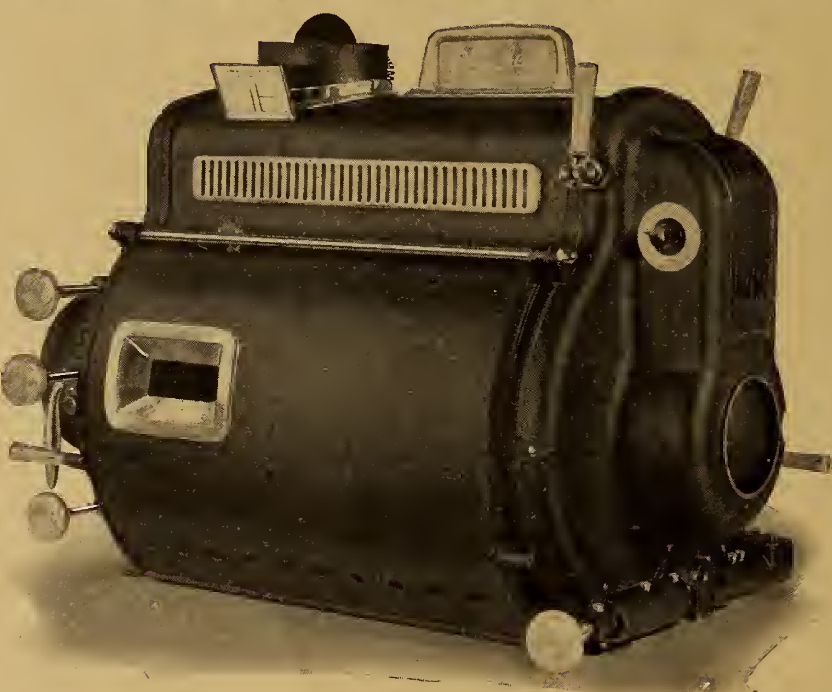

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INTERNATIONAL PROJECTIONIST

VOLUME VIII NUMBER 2

FEBRUARY 1935

EFFICIENT OPERATION OF THE SUPREX CARBON ARC

W. C. Kalb

NATIONAL CARBON COMPANY

THE advent of the powerful D.C. high-intensity condenser lamp in the larger theatres and, later, of the reflecting type Hi-Low lamp in theatres of intermediate size, set a new standard of motion picture projection. Theatre-goers, by their increased patronage, have shown their appreciation of the brilliant screen illumination which the high-intensity arc provides and also of the higher level of general illumination which it permits.

The need for a more powerful source of screen illumination in the smaller theatres has long been evident. This need is more pronounced today than ever before because of the growing popularity of color pictures. Color pictures require a higher level of light at the aperture plate than do black-and-white pictures, and their full color value is best realized with the snow-white projection light characteristics of the high-intensity arc.

To bridge the wide gap between the quality and intensity of light supplied by the high-intensity arcs in the large theatres and that available from the low-intensity D. C. lamps used in the smaller theatres, the Research Laboratories of National Carbon Company, Inc., developed new carbons which extend the field of the high-intensity arc into a lower current range than had previously been practicable.

These new high-intensity carbons are much smaller in diameter than have heretofore been used for projection. Another point of difference is that they are copper-coated, whereas the positive carbons of larger diameter are uncoated. This metallic coating improves the electrical conductivity, permitting operation at high current density without the use of a cooling head, and also allowing the carbon to be gripped at any desired distance from the arc.

The new projection lamps developed especially for the use of these carbons are of the reflecting type but differ in several respects from the Hi-Low lamp and from the condenser type high-intensity lamp. These older types hold the negative carbon at an angle to the positive which is gripped at a short distance from the arc and rotated during operation. The new lamps are designed to hold both carbons in a horizontal position gripped at or near the end away from the arc, and neither carbon is rotated when the lamp is operating.

In the Suprex Type D. C. Lamp discussed in this article, the axis of the negative carbon, while parallel to that of the positive, is slightly lower. Compared with the low-intensity, D. C. mirror arc, these new high-intensity arcs provide a greatly increased volume of useful light. Improvements in the optical system are a further aid to their efficiency.

The crater of this small-diameter, non-rotating positive carbon assumes a cup-like form, the same as in the higher amperage lamps in which the positive carbon is rotated. The brilliancy of this crater is more than twice that available from the crater of the D. C. low-intensity arc. The light has the pure, snow-white quality which, in pleasant contrast to the yellowish tinge of the light from the low-intensity D. C. arc, has done so much to popularize high-intensity projection. The

small diameter of the carbons, however, calls for accurate control of arc current and crater position in order to obtain full efficiency of light output and uniform distribution of light on the screen. Fortunately, this detail has been taken care of in a highly satisfactory manner by the lamp designers.

With a view to giving the projectionist data which will enable him to obtain the best possible results from this new projection unit, there are here summarized the conclusions drawn from a study of this arc in relation to the light on the projection screen. In actual practice there are several variables which simultaneously affect the light on the screen, but in this investigation the effect of each variable has been studied independently. By combining the data obtained on these several variables, however, the resultant effect can be predicted.

Carbon Trims

Three trims are now available for these Suprex type D. C. lamps. These are shown in Table A.

The rate of carbon consumption is the same for all of these trims at corresponding limits of their current range. To illustrate, with the 6mm/5mm trim at 32 amperes, the 7mm/6mm trim at 42 amperes, or the 8mm/6.5mm trim at 56 amperes, positive carbons are consumed at an average rate of 6.5 inches per hour and negative at an average rate of 3.0 inches per hour. At the respective upper limits of current range—40, 50 and 65 amperes—average carbon consumption per hour is 13.5 inches for positive and 4.5 inches for negative.

Since, at the present time, most of the lamps and auxiliary equipment in use have been designed to use the 7mm positive/6mm negative trim, the discussion of the effect of the several variables is based on studies of this trim in a typical lamp. The specific values mentioned are applicable only to this trim, but the conclusions reached may be applied, in a general sense, to the smaller and larger trims.

Proper Arc Length

If the arc current is held constant and the positive carbon maintained at a constant distance from the reflector, the arc length may be varied substantially without appreciably affecting the total light on the screen or its distribution. An arc length of 9/32" to 5/16" is usually maintained with the 7mm/6mm trim. With a very short arc length, such as 3/16", there is built up on the negative carbon a reddish deposit which, unless removed, may cause difficulty in restriking the arc. On the other hand, an arc length of 3/8" or more introduces perceptible wavering of the arc which tends to cause a fluctuation in the screen light.

If the arc current be increased, while the arc length and the distance of the positive crater from the reflector be held constant, there is a very definite increase in the screen light but very little change in light distribution. An increase in arc current from 40 to 50 amperes, amounting to 25%, results in a 47% increase in the light on the screen. The ratio of brilliancy from center to sides of screen is slightly increased by this increase in arc current, but not enough to present an objectionable contrast. There is also an increase in crater depth and in rate of carbon consumption.

The rate of increase in carbon consumption, with increased arc current, is greater for the positive carbon than for the negative. If the arc is burned at too low a current, the crater is very shallow and the light is not uniform in color. On the other hand, at too high an arc current carbon consumption is excessive and the light is not steady.

If the distance of the positive crater from the reflector is varied, while arc length and current are maintained constant, marked variation in screen light and distribution result. Observations were made with a 7mm/6mm trim operated with 5/16 inch arc length and 45 amperes arc current. Moving the positive crater from a point 3.70 inches from the reflector to a point farther away causes a sharp increase in light. This reaches a maximum, representing 77% increase in total screen light, at a point 3.82 inches from the reflector. Further movement away from the reflector reduces the total light, but at a slightly less rapid rate. At 3.90 inches from the reflector the total light is 49% above that at 3.70 inches, or 16% less than at the peak.

With the positive crater 3.70 inches from the reflector, the distribution of light on the screen is uniform, the sides being as bright as the center. If the arc is moved closer to the reflector, the light at the sides of the screen becomes brighter than that in the center. This condition is very undesirable. Moving the arc away from the reflector causes a more rapid increase in brightness at the center of the screen than at the edges. After a point 3.84 inches from the reflector is reached, the contrast in brightness between center and sides of the screen becomes very noticeable.

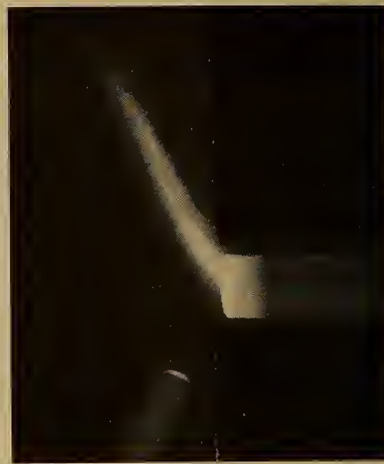

Figure 1

The distance between the positions 3.70 and 3.84 inches from the reflector may be taken as an arbitrary range of satisfactory projection. This allows a range of only 0.14 inch for the arc position. With the 8mm/6.5mm trim this range is slightly greater.

Arc Control

This narrow range of arc position results from a combination of four factors: the curve of light distribution emitted from the positive crater, the magnification of the optical system, the diameter of the crater opening, and the dimensions of the film aperture. None of these factors is under the control of the projectionist, so it is obviously desirable that the control mechanism of the lamp be adapted to maintaining the position of the arc within these limits. This is very effectively accomplished by a number of the lamps which are now on the market.

The ratio of the feed of the positive and negative carbons can also be regulated, either by provision for adjustment in the lamp itself or by a comparatively simple change in the lamp parts. From the figures on carbon consumption previously given, it will be noted that the ratio of positive to negative carbon consumption is 2.17:1 at the lower limit of current range and 3:1 at the upper limit. Increase of arc current, without change of feed ratio in the control mechanism, will therefore tend to increase the arc length as the carbons are consumed; and reduction of arc current will tend to reduce the arc length.

It is known that the voltage drop across the arc stream of the high-intensity D. C. arc from the positive to the negative carbon is comparatively low and does not increase materially as the current is increased. On the other hand, the voltage drop within the positive crater is comparatively high and does increase substantially as the current and crater depth increase.

As shown in an earlier paragraph, the

TABLE A

Positive Carbon	Negative Carbon	Recommended Arc Currents	Voltage Range
6mm Suprex Positive	5mm Suprex Negative	32-40	31-40
7mm " "	6mm " "	42-50	31-40
8mm " "	7mm or 6.5mm "	56-65	31-40

increase in voltage and crater depth which accompanies increase in arc current causes a very material gain in the useful light of the arc. If there is a disturbance in the high-intensity effect—for example, a decrease in the voltage drop in the crater caused by a crooked crater due to poor alignment of the carbons—the resultant effect on the arc will depend upon the characteristics of the power source.

If the power source is 115-volt line or an 80-volt motor-generator set, a comparatively large amount of ballast resistance is required to reduce this voltage to the value of 31 to 40 volts required at the arc. Consequently, a decrease in arc voltage would cause only a small increase in arc current and appreciable time would be required to restore the normal crater depth. Such a source is, therefore, undesirable from the standpoint of arc stability as well as that of economy.

However, if a power source with a no-load voltage near that of the arc and a falling volt-ampere characteristic curve is used, or a constant voltage source only slightly higher than the arc voltage and requiring a comparatively small amount of ballast resistance, then a disturbance resulting in lowered arc voltage would produce a decided increase in current which would immediately tend to restore the proper crater depth and cause a return of arc voltage and current to normal conditions. A power source from which the current decreases with decrease of arc voltage is entirely unsuited, since the reduced current would further decrease the crater depth and arc voltage and an unstable condition would result.

Several different types of units are now on the market which have characteristics suitable for these non-rotating, high-intensity, D. C. arcs. Each has its own peculiar advantages but all are characterized by a comparatively large increase of current with a decrease in arc voltage. These units fall into three classes:

1. Low voltage motor generator sets with constant voltage characteristic. These are suitable for use with two lamps and their individual ballast resistances, connected to the generator in parallel.
2. Motor generator sets with falling volt-ampere characteristic and a no-load voltage near that of the arc. These require no ballast resistance but do require a separate generator for each lamp.
3. Rectifiers with falling volt-ampere characteristic which, likewise, require no ballast resistance but require a separate unit for each lamp.

Figure 2

If a single-phase rectifier is used, the fluctuation in voltage and current may cause a noticeable beat in the screen light unless a sufficiently large choke coil is used on the output side of the rectifier. With two-phase and three-phase rectifiers the variation in instantaneous values of current and voltage is small and is not noticeable in the light on the screen.

Stabilizing Magnetic Flux

In the high-intensity lamps with rotating positive carbon the negative carbon has always been placed at an angle to the positive. The lines of magnetic flux surrounding the carbons, generated by the current passing through them, are thus crowded together below the arc and spread out above it. This produces a magnetic force on the arc stream which, in conjunction with its natural flow, projects the tail flame of the arc upward and forward from the positive crater, as shown in Figure 1.

The carbons in these new Suprex type lamps, however, are both held in a horizontal position and the magnetic field is uniform on all sides. The tail flame of the arc therefore surrounds the positive crater in an almost uniform layer, as shown in Figure 2. This condition lacks stability, and slight disturbances, such as a slight change in the alignment of the carbons, may cause the crater to burn off on one side and produce a noticeable change in the light on the screen.

In some of these lamps an auxiliary magnetic field has been introduced which augments the magnetic flux below the arc and opposes that above it. This gives the tail flame a definite upward trend, as shown in Figure 3, and assures greater stability to the position of the arc stream and the form of the crater.

The axis of the negative carbon is placed slightly below that of the positive to compensate for the angular direction of the arc stream. The improvement in the steadiness of screen illumination resulting from the use of this auxiliary magnetic flux is very noticeable, especially when the lamp is operated from a 115-volt line through a large ballast resistance. It is, of course, essential that this field be of the right direction, and care must be taken, when making any repairs to the lamp, to see that the direction of this auxiliary flux is not reversed.

Distance from positive crater to reflector is the most important item in the control of this arc. Variation in this distance causes decided variation in both the total screen light and the contrast in brightness between center and edges of the screen.

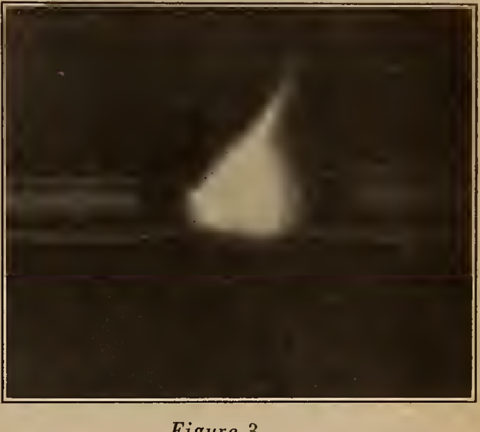

Figure 3

Ratio of positive-to-negative carbon feed should be adjusted so that uniform arc length and position can easily be maintained at the desired operating current.

Increasing arc current increases positive-to-negative ratio of carbon consumption.

Increasing arc current increases total screen light but does not greatly affect the light distribution, that is, does not greatly modify the *relative* intensity of illumination at center and edges of the screen. Arc current should be held within the recommended limits for the trim in use.

Variation of arc length does not appreciably affect the total light on the screen nor its distribution, provided the arc current and position of positive crater remain unchanged. Extreme variation of arc length, however, introduces operating difficulties.

The most satisfactory source of power is a constant voltage source near enough to the arc voltage to permit the use of a small ballast resistance or a source with a falling volt-ampere characteristic and a no-load voltage not greatly in excess of the arc voltage.

With a suitable source of power and proper adjustment of the control mechanism for the conditions under which the arc is operated, these new Suprex type, D. C., high-intensity arcs supply the long-felt need of the smaller theatres. They provide all the advantages of light quality and intensity which the higher amperage high-intensity lamps have given the larger theatres. They produce 100 to 200% higher levels of screen illumination than is available from the low-intensity D. C. mirror arc and at a lower operating cost per unit of light volume. They constitute one of the most striking of recent advances in the art of motion picture projection.

STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING EQUIPMENT

Aaron Nadell

VII. W. E. Motor Control Cabinet

FIGURE 1 is a schematic diagram of an A. C. motor speed control circuit using four vacuum tubes. The motor is shown at the extreme left. The motor proper consists of two parts, the stator and the rotor. The stator is supplied with alternating current through terminals 1 and 2 of the control cabinet. The 110-volt A. C. supply is wired to the two bottom terminals of the cabinet.

From these terminals the circuit can be traced right through the two 10-amp. fuses, F-1, thence through the safety switches D-3 and D-4, thence through switch D-1, by means of which this motor is started or stopped, and thence upward and leftward to the stator winding. (A branch circuit supplies the primary of the power transformer, T-1 from the same power source.)

The A. C. flowing in the stator windings generates an alternating voltage in the rotor. In other words, the stator windings may be regarded as the primary, and the rotor windings as the secondary, of a transformer. The rotor is equipped with brushes which are wired, through terminals 3 and 4 of the control cabinet, to a reactance coil, L-2. (That coil is readily found in the drawing by following the wire that runs right from terminal 3.)

Therefore, A. C. flows in the rotor windings, completing its circuit through the brushes and the reactance L-2. The alternating magnetic field created by this current reacts with the alternating magnetic field that surrounds the stator, causing the rotor to revolve.

The speed with which the rotor revolves depends upon the strength of its field; the strength of its field depends upon the strength of its current, and the strength of its current depends upon the impedance of the coil L-2. Any influence that can change the impedance of that coil will control the speed of the motor.

The Inductor Generator

An iron wheel of irregular outline is shown in the drawing just above the rotor. This is mounted on the rotor shaft and revolves with it. It constitutes one part of the inductor-type generator that is built into the same casing with this motor. The other two parts of that generator are the field (shown just above the rotating element) and the stationary armature, shown to the right of the field.

The field is supplied with D. C. through a rectifier tube (V-3) inside the control cabinet. Both the field and the armature are wound on an iron core. This core is equipped with a gap through which the projections of the rotating element pass as the motor revolves. Every time one of those projections enters or leaves the gap the strength of the D. C. magnetic field that surrounds the inductor field winding is altered, and a pulse of A. C. is generated in the armature winding.

When this motor is revolving at the correct speed of 1200 r.p.m. the current generated in the inductor armature is 720 cycles. When the motor revolves more slowly the projections of the rotating element enter the gap of the core less often per second, and the frequency generated in the armature winding is less than 720. When the motor speed exceeds 1200 r.p.m., the frequency generated in the armature is more than 720.

The A. C. generated in this armature enters the control cabinet through terminals 4 and 6. It acts through the internal circuits of the cabinet to vary the impedance of coil L-2, and therefore to control the speed of the motor.

The Bridge Circuit

Although this cabinet is designed to operate automatically to keep the speed of the motor constant at 1200 r.p.m., it may also be used in another way. By throwing a switch the automatic control is open-circuited, and the speed of the motor is controlled by hand, through a potentiometer knob on top of the cabinet. The motor can then be operated at any speed between 1,000 and 1,4000 r.p.m. The switch that permits the projectionist to select either manual or automatic control is D-2, located at the top center of the drawing. Thrown to the right it provides manual control; thrown to the left, it switches in the automatic regulation.

Assuming that this switch is thrown to the left, the A. C. from the inductor armature is provided with two parallel paths inside this cabinet. The circuit may be traced right from terminal 6 to the lower blade of switch D-2. At this point two paths divide. One runs right, down through the primary windings of T-3, and thence left to terminal 4. The other runs left through the lower blade of D-2, down through the retard coil L-1 (and through the condenser built into that coil), thence down through R-13, R-14 and R-11, and left to terminal 4.

One vital fact about this divided circuit is that when the A. C. input is precisely 720 cycles the impedance of the two paths is precisely equal, and the current divides 50-50 between them.

But when the frequency is either more or less than 720 cycles the impedance of the two arms is *not* balanced. At frequencies below 720, the retard coil L-1 acts like a resistance in series with a condenser. At frequencies higher than 720 it acts like a resistance in series with a choke coil. The reason for this is that the coil-and-condenser combination which constitutes L-1 is tuned at the factory to offer minimum impedance at precisely 720 cycles. When any other frequency is applied, L-1 no longer balances the upper half of the primary winding of T-3.

When the current is 720 and the two parallel paths offer the same impedance, the voltage drop across L-1 is precisely the same as the voltage drop across the upper half of T-3. Therefore, the potential difference between the mid-point of T-3 primary and the lower end of L-1 is zero, and no current flows across the "bridge" (the double primary of T-2). But when the current is other than 720 cycles, the voltage drop across L-1 is *not* the same as the drop across the upper half of T-3 primary. Under such circumstances a potential difference exists between the lower end of L-1 and mid-point of T-3 primary, and current does flow across the "bridge."

This "bridge" consists of the two paralleled coils constituting the primary winding of transformer T-2, and of the condenser C-6, which is in series with that primary.

At frequencies below 720 cycles the effect of L-1 and C-6 is to place the current through T-2 primary 180 degrees out of phase with the current through T-3 primary. Conversely, at frequencies above 720 the currents through the two

primaries are in phase. At exactly 720 cycles there is, as just said, no current at all through the primary of T-2. This phase-change of 180 degrees, when the frequency of the inductor current passes through 720 cycles, controls the speed of the motor by acting through the vacuum tubes to increase or decrease the impedance of coil L-2.

The filament of tube V-4 is heated with A. C. derived from the third secondary of the power transformer T-1. The plate of this tube is supplied with 720-cycle A. C. through transformer T-3. V-4 is called the "detector" tube of this cabinet. Its operation may be made clear by describing it as a grid-controlled rectifier, which in fact it is.

V-4 is given three sources of grid bias. The first is a voltage drop existing across R-8, the resistor just under V-3. We may trace the bias circuit from the left-hand side of V-4 filament right to the upper or positive end of R-8, down through R-8 and left through the bias-adjusting arrowhead; thence down, left and up to the right-hand, or positive, side of R-2, the voltage drop across which is the second source of grid bias for V-4; thence up through R-3, R-4 and R-5, to the right-hand side of T-2 secondary.

The 720-cycle A. C. generated in this secondary constitutes the third source of grid voltage for V-4, serving to increase and decrease the fixed bias 720 times a second. From the left-hand side of this secondary upward and right through the upper blade of switch D-2 to the grid of V-4. Condensers C-2 and C-3 filter the current flowing through R-2, and thus steady the bias of V-4.

Now, remembering what has just been said of the phase relations between the transformers T-2 and T-3, it is plain that when the inductor current is less than 720 cycles, the grid of V-4 will swing negative while the plate of V-4 is positive. Since space current can flow through any vacuum tube *only* when its plate is positive, the grid of V-4 will be more negative during the only part of the A. C. cycle that matters to the tube, and the space current through the tube will be lowered.

On the other hand, when the inductor output is more than 720 cycles, the grid of V-4 will swing positive (less negative bias) while the plate is positive (which is the only time that matters), and the space current through V-4 will be larger.

Therefore, at motor speeds above 1200 the space current through V-4 is relatively large. At motor speeds below 1200 the space current through V-4 is relatively small. The space current through V-4 is used to control the bias of the grid-controlled rectifiers V-1 and V-2.

V-1 and V-2 operate in a full-wave rectifier circuit. Their filaments are supplied by the second secondary of the power transformer, T-1. Their plates are powered by the topmost secondary of that transformer. The grids are maintained at a *positive* bias by means of the voltage drop through resistor R-8, which is seen just under tube V-3; but the voltage drop through resistors R-6 and R-7, under V-4, tends to counteract this bias.

Tracing from the grids of V-1 and V-2 upward, this circuit runs to the lower, or *negative*, end of R-7, through the resistors and up to the left-hand leg of V-4, thence right to the upper, or *positive*, end of R-8, down through R-8 and left at the arrowhead grid bias contact, down, left, down through the milliameter and right to the filaments of V-1 and V-2.

Condenser C-7, which is shunted around resistors R-6 and R-7, serves to filter the half-wave voltage drop through those resistors and to steady its effect upon the grids of V-1 and V-2.

At motor speeds above 1200 r.p.m. the space current through V-4 is, as just explained, relatively large, consequently the voltage drop across R-6 and R-7 is relatively large, and the grids of V-1 and V-2 swing toward negative. Under those conditions the space current across these tubes is reduced. At motor speeds below 1200 r.p.m., the space current through V-4 is relatively small, the grids of V-1

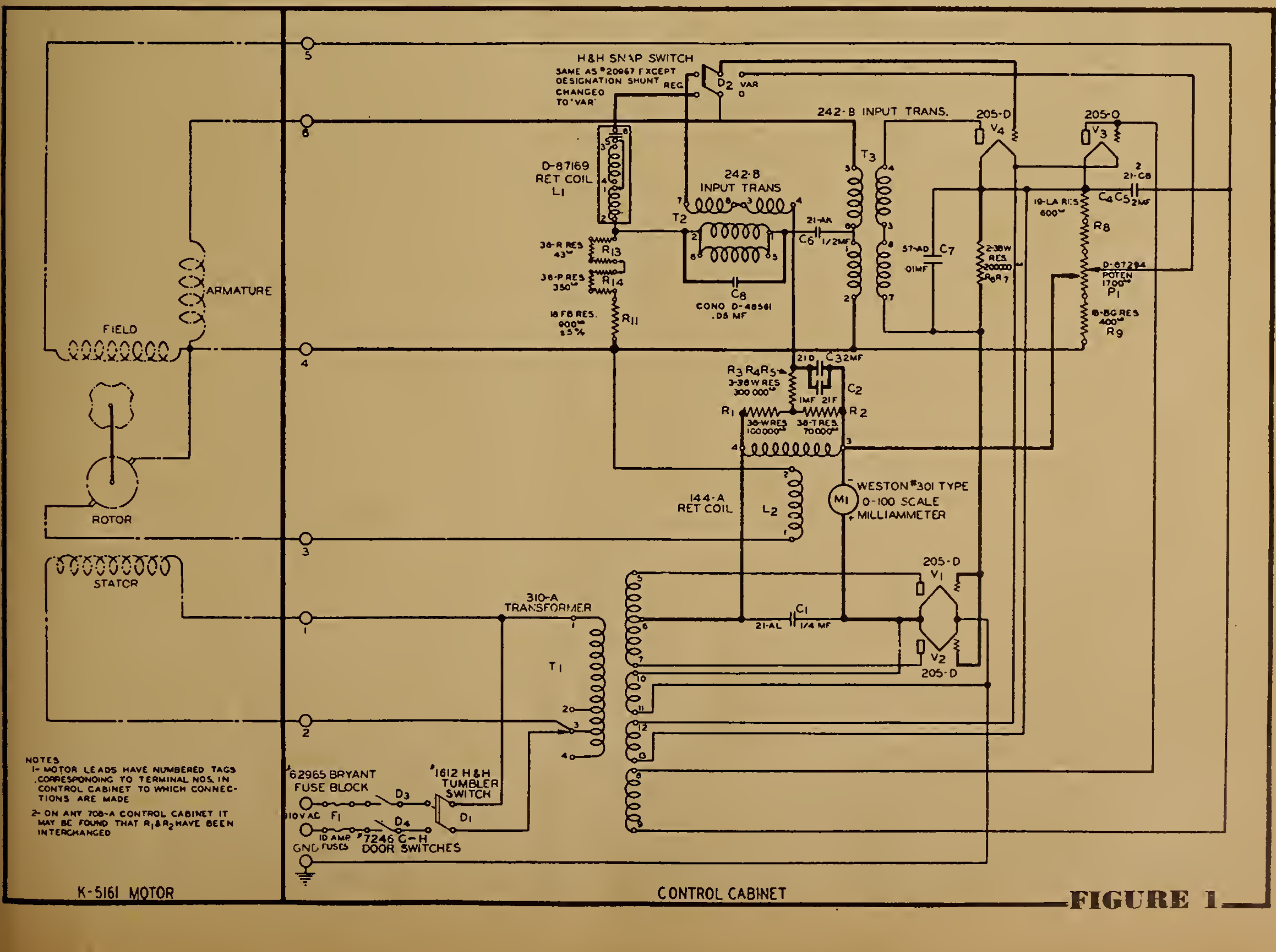

FIGURE 1

and V-2 become more positive in bias, and the space current across these tubes is comparatively large.

The space current of V-1 and V-2 may be traced through its circuit as follows: from whichever end of the top secondary of T-1 may be positive at the moment to the plate of the corresponding tube, through the vacuum to the filament, left from filament and up through the milliameter.

Here the current divides: one branch flows through resistors R-2 and R-1 to provide grid bias for V-4; while the other branch flows through the coil shown just below these resistors. At the left-hand end of that coil the two branches reunite and the circuit continues down and left to the center-tap or negative terminal of the secondary of T-1. The condenser C-1 serves as a filter to steady the rectified current through the coil, and prevent "hunting" in the motor.

Saturated-Core Reactance

The coil through which the rectified current flows is wound on the same iron core with L-2, and constitutes part of the 144-A retard coil assembly. At low current values through V-1 and V-2 (corresponding to motor speeds above 1200 r.p.m.) the impedance of coil L-2 is comparatively large, thus reducing the rotor current and, consequently, the speed of the motor. At high current values through this rectifier (motor speed low) the core of the 144-A retard assembly is *saturated by the rectified current*—that is, magnetized as completely as it ever can be. This fact operates to decrease the impedance of the winding L-2, thereby permitting the rotor current to increase, and increasing the speed of the motor.

Summary

The motor consists of a stator and a rotor. The rotor current completes it circuit through brushes and the coil, L-2, which is part of retard assembly 144-A. The impedance of coil L-2 controls the rotor current, and therefore, speed of the motor.

An inductor generator built into the motor develops 720-cycle A. C. at proper motor speed, higher frequencies at higher speed, and lower frequencies at lower speed. This A. C. output is wired across a bridge circuit consisting of the following parts: an arm composed of coil L-1 and the resistors R-13, R-14 and R-11; an arm consisting of the two halves of the primary of T-3, and a bridge consisting of the primary of T-2 and the condenser, C-6, in series with it.

At 720 cycles, corresponding to 1200 r.p.m., this bridge is balanced and no current flows in T-2. At less than 720 cycles, L-1 acts as a resistance in series with capacity, causing current to lead 90 degrees, while C-6 rotates the current an additional 90 degrees ahead, bringing it 180 degrees ahead of the current through T-3. At more than 720 cycles, L-1 acts as a resistance in series with inductance, causing current to lag 90 degrees, which lag is corrected by condenser C-6, resulting in current through T-2 keeping in phase with current through T-3.

Space current flows through V-4 only while its plate (powered by 720-cycle A. C.) is positive. Therefore, when the frequency is slightly above 720 cycles (excessive motor speed) which is when the grid of V-4 swings toward positive at the same time that the plate is positive, the space current through V-4 increases. This increases the voltage drop across R-6 and R-7, thereby swinging the grids of V-1 and V-2 toward negative, decreasing the space current through those tubes, decreasing the rectified D. C. in the horizontal coil of the 144-A retard assembly, and consequently adding to the impedance of coil L-2. The increase in the impedance of that coil reduces the rotor current and slows down the motor.

When the motor speed is less than 1200 r.p.m. and the inductor frequency is less than 720 cycles, the current in T-2 is 180 degrees out of phase with that in T-3. The grid of V-4 then swings negative while the plate of that tube is positive, the space current through the tube is reduced, and the train of events just reviewed is reversed.

V-3 is a rectifier tube that performs two functions: it provides D. C. for the field of the inductor machine and sup-

NEW VISTAS IN SOUND TRANSMISSION

Leopold Stokowski

CONDUCTOR, PHILADELPHIA SYMPHONY ORCHESTRA

Rated by many as the world's foremost conductor, Leopold Stokowski evidences herein his keen insight into the technical requisites of good sound transmission, the result of participating in extended technical tests for several years now. Appearing in "The Atlantic Monthly" (Jan., 1935, Vol. 155 *No.* 1*), this article appealed mightily to this writer, whose unshakable conviction it is that projectionists should be keenly interested in the allied arts as a means of broadening their perspective of the whole field of sound transmission. This is the second and final installment.*—Editor.

II

MUSIC can be conveyed by the radio we now have in our homes—sometimes called 'space radio'—or by wired transmission, sometimes called 'wired radio.' Space radio has the disadvantages of a compressed frequency range, a compressed dynamic range, fading, and electrical disturbances and static that sometimes ruin reception. Up to this time, physicists have not found a way to protect music that is conveyed by space radio against these extraneous sounds.

Wired transmission, or wired radio, in which the full range of frequencies and the full dynamic range can be transmitted, protects music against fading, static, and disturbances of every kind. With wired transmission, we could all hear, in our homes, in public buildings, in recreation centres, music that would sound exactly as it sounds in the concert hall.

An interesting test of this method of transmission, made on April 27, 1933, shows that it is entirely practicable and that it gives superior results. The test, made by the Philadelphia Orchestra, was sponsored by the National Academy of Sciences and was given and arranged by the research and engineering forces of the Bell Telephone Laboratories.

This is what was done. The full Philadelphia Orchestra played a symphony concert in Philadelphia. The music was picked up by specially designed microphones and transmitted over underground wires into Constitution Hall in Washington. Here, through power amplifiers controlled by special apparatus, I was able to control, in Washington, music made in Philadelphia and to send it forth to the Washington audience of scientists musicians, music critics, and music lovers. It is an amazing thing that this possibility has existed now for two years and no use has been made of it.

Increased Intensity Range

Nor is the scope of wired transmission limited to its capacity to convey music to our homes with the same quality that it would have in the concert halls. Wired transmission can so increase the intensity range that it would be possible —in a recreation park, for example—to listen to music with a much greater intensity range than is heard in the concert hall. The dynamic contrasts and accents, the slow building up of the sonority to climaxes, the gradual decrease of tone and fading out can be so enlarged —by wired transmission—that the music acquires greater eloquence, energy, and significance.

Nor is even this the sum of the full possibilities of wired transmission. Through it, by a selective process, it is possible so to enrich certain parts of the tapestry of sound, bringing them out in

(Continued on page 28)

plies part of the grid bias for the other three tubes. Its filament is heated, in parallel to that of V-4, by the third secondary of the power transformer T-1. It has no grid bias, but operates as a conventional two-element rectifier, the grid being wired to the plate and serving merely as a physical extension of the plate. The plate is powered by the fourth or bottom secondary of transformer T-1.

This half-wave rectifier functions only when the upper end of that secondary is positive. Then the circuit may be traced to the plate of the tube, to the filament of the tube, downward through R-8 and R-9, left from the bottom of R-9 to terminal 4 of this control cabinet, thence through the field winding of the inductor, upward, right through terminal 5, right to the right-hand edge of the drawing, down to the bottom of the drawing, and left to the lower or negative end of the bottom secondary of T-1.

Condensers C-4 and C-5, just under V-3, act as filters to smooth the half-wave rectified current. The voltage drop across R-8, which helps bias the grids of the other tubes, is provided by this current.

D-2 Switch Action

When the "Reg.-Var." switch at the top center of the drawing is thrown to the right, eliminating automatic action and permitting manual control the circuits through coil L-1 and transformer T-2 are opened. The entire output of the inductor flows through the primary of T-3, while the grid of V-4 is disconnected from the secondary of T-2 and joined instead to the right-hand or potentiometer arrowhead resting against R-8 and R-9.

Under those circumstances the grid bias circuit of V-4 may be traced as follows: right from the left-hand leg of the filament of V-4 to the top or positive end of R-8; down through R-8 to the right-hand potentiometer contact; thence right, up and left to the upper blade of D-2, and thence right and down to the grid of V-4.

Brief Recapitulation

The space current through V-4 is then controlled by adjusting a potentiometer knob on the top of this cabinet. The inductor output frequency has nothing to do with controlling the speed of the motor, but the remainder of the control circuits operate as before.

The grid bias of V-4 (now purely a D. C. bias) governs the space current of that tube; the space current determines the voltage drop across R-6 and R-7; that drop modifies the bias of V-1 and V-2; the space current through V-1 and V-2, flowing in the horizontal coil of the 144-A retard assembly, controls the saturation of the core of that assembly and therefore the impedance of L-2, and the impedance of L-2 determines the speed of the motor.

HINTS ON EFFICIENT LOW-INTENSITY OPERATION

Rolf R. Gruning

THE modern low-intensity arc, while perhaps not the most efficient, still is the most economical way of providing suitable screen illumination for the small theatre. It is surprising, therefore, to note how little is known about the technical aspects of this arc.

The amount of current flowing through these low-intensity carbons is rather small in relation to their diameters. Thus, if two carbons of the same diameter were used together, the arc stream would not hold its position but would wander around the rim of the crater, producing a dim, unsteady light that could not be focussed. Even should the positive hold the crater correctly, the light would be dull and the crater itself would not be as large as it should be.

By far the most popular low-intensity carbon trim on the market today is:

12 mm. x 8″ Positive cored
8 mm. x 8″ Negative solid

The normal load for this trim is from 18 to 23 amperes. Due to the use of the smaller negative, the current density in the negative has been "stepped up," and the resultant light is far steadier and brighter. The stream of electrons, so to speak, has been focussed on the center of the positive crater where it will be most effective.

Results of Overloading

If a carbon trim be overloaded, is carrying too much current, the arc has a tendency to hiss, the light becomes unsteady and the intensity is lowered. These conditions are caused by the temperature at the arc reaching the vaporizing temperature of carbon. Beyond this point no increase in current will make the carbons produce more light.

When burned over their rated amperage the carbons will burn off proportionally much faster than under correct conditions. Many projectionists still insist on crowding too much current into the carbons, thinking that thereby the light intensity will be increased. According to the above facts this is an obvious fallacy.

Still another symptom of overloading is penciling of the carbons, both from the positive and the negative. Tests were made in which a considerable overload was applied to these 12 mm. and 8 mm. carbons, and the results were typical of this condition. Within the first ten minutes the diameter of the positive decreased from 12 mm. to approximately 8 mm. over its whole length, except for an inch or so that was held in the clamp, and the negative also thinned appreciably. If the test had been extended to its logical conclusion, the carbons would soon have been so weakened that they would have broken off under their own weight.

If the carbons do not carry enough current, the arc stream will wander over the face of the positive crater, and the core of the positive will become hollowed out much faster than the surrounding shell. This is caused by the core having a softer consistency than the shell, thus burning more easily. Naturally, under these conditions, maximum light intensity cannot be realized.

Correct Amperage Factors

It is of the utmost importance, therefore, that the carbons be burned at the amperage for which they are designed. Low-intensity carbons are generally made with a leeway of four or five amperes, so that best results are obtained by experimentation within this range. The 12 mm./8 mm. combination, for instance, burns best in the center of its range of from 18 to 23 amperes, or at about 21 amperes. Individual cases differ, however, and slight differences in voltage, the general efficiency of the lamp, etc., will all be factors in determining the correct amperage.

An interesting characteristic of projection carbons in general is their ability to absorb moisture. If the cardboard box in which the carbons are packed becomes wet enough so that the moisture penetrates to the carbons themselves, certain organic constituents of the cardboard will be carried in solution and deposited on the carbons. This occasions black spots which will dry in, the effects of which require but brief mention.

Effect of Dampness

When one of these carbons is put into the projector, the heat will cause these organic substances to act on the carbon, and hollows in the side of the carbon result. As the carbon gets shorter and the affected section gets nearer the flame, this hollow increases in size. By the time this section arrives at the flame it is frequently large enough to throw it out of focus and to produce a highly objectionable flicker.

It is extremely important that projectionists using low-intensity equipment have a thorough knowledge of carbon characteristics and thus insure maximum efficiency.

S.M.P.E. HEAD ASKS EXHIBITOR AID IN IMPROVING REPRODUCTION

The appended paper was prepared by H. G. Tasker, President of the S.M.P.E., for presentation (by H. Griffin of International Projector Corp.) at the annual convention of the Motion Picture Theatre Owners of America in New Orleans. The paper drives home to the exhibitor that the technical aspects of theatre operation are of vital importance to its success, and pleads for more active cooperation by exhibitors in elevating and maintaining high standards of reproduction.—Editor.

EXHIBITORS and engineers have fewer opportunities than would be expected to get together and discuss their mutual problems. It is clear enough that there should be many such opportunities because the theatre manager is selling what is primarily a technical product—the result of engineering methods—to the public; and the engineer is trying to produce a quality of product which will consistently meet the needs of the exhibitor and will satisfy the public . . .

Let me make the somewhat startling statement that a theatre is a sort of factory, run by engineering equipment, and turning out a definite engineering product. It is easy enough to substantiate this statement. As we approach a theatre the blaze of light on the marquee and within the lobby at once fixes our attention and draws us into the house. But what is the blaze of light except many carefully selected electric lamps of various colors, suitably mounted, and interconnected in such a way that switches and flashers can create attention-arresting effects? The installation and maintenance of this lighting equipment is an entirely everyday engineering problem of a simple sort.

Passing through the lobby we see posters and photographs, all made by technical methods and using modern equipment. In the box office an electrically-controlled ticket vender and change-maker are other examples of engineering equipment. We pass into the theatre and are either attracted or repelled by the appearance of the house depending upon its architectural design and the engineering skill used in properly lighting the theatre. We either stumble down the aisle and search in vain for vacant seats in a too dim theatre; or, on the other hand, we may find the beauty of the picture on the screen reduced by excessive or incorrectly distributed house lighting.

More technical problems, these, but of major importance in producing the right impression on the audience.

Quality Projection Pays

Once seated, we immediately encounter a series of technical triumphs or failures. Consider first the picture on the screen. I have been told that there is many a manager who has not the least objection to spending considerable sums of money for paper in the lobby but who protests violently to replacing a sprocket in the projector or to making simple changes or additions in the projection room to enable consistent and improved projection. The exhibitor who is satisfied with dim, uneven, or out-of-focus pictures is injuring himself to a tremendous extent.

It may be true that no member of the audience gets up and walks out because the projection is unsatisfactory—but you may be sure that in the long run the bright clear picture brings back the audience—and that is what counts on the balance sheet.

I cannot too strongly emphasize the necessity of keeping the screen and projection equipment in first class condition and of encouraging the projectionists to do the best sort of job.

Even today, sound reproduction in many theatres leaves much to be desired. If the sound head of the projector, the amplifying equipment, and the loud speakers, are not of high quality, properly installed, and systematically checked on performance, it is fairly certain that there will be a poor quality of reproduction and even break-downs at unpleasantly short intervals. Again, while no one may walk out of the theatre or smash the fittings in his anger, it is certain that an audience straining its ears to understand at least a portion of the dialogue will be badly dissatisfied and will show its displeasure in the most deadly fashion—namely, *by not coming back to the theatre.*

Many an exhibitor has wondered why his competitor succeeded—when the answer could be found in his own theatre . . .

I will pass over dozens of other theatre problems which involve engineering, such as the choice of projector lamps, the construction of theatre seats, the inspection of the theatre screen, the acoustic treatment of the theatre, means for keeping street and lobby noises out of the auditorium and the like. I am sure you will agree, however, that the theatre is strictly an engineering product with a thin veneer of artistic embellishment.

I might even go so far as to say that a theatre is a sort of mill into which silver images on celluloid are poured and which then grinds out entertainment. Please do not assume that I mean to imply that this is the way the theatre should be presented to the public. So far as the public is concerned, the theatre should be a glamorous and romantic place, and the skill of the exhibitor should be called on to present it in this fashion . . .

It is to the advantage of the exhibitor and engineer alike to keep the theatre factory running smoothly and turning out a product for which the public is eager to exchange its dollars . . .

S. M. P. E. Preparing for Hollywood Meeting

Tentative plans for the Spring Convention of the Society of Motion Picture Engineers, to be held at the Roosevelt Hotel in Hollywood, May 20 to 24, list nine technical sessions. Two of these are scheduled for evenings to permit visits to the studios in the afternoons.

Studios of Fox, First National, and Walt Disney will be open for S.M.P.E. visitors, as well as the California Institute of Technology. Hollywood's finest theatres will provide free passes to all members during the convention. A special program of entertainment has been provided for the ladies.

Of particular interest will be the exhibit of new studio and theatre equipment. A similar exhibit proved to be one of the features of the last Hollywood convention, and it is expected that this year's display will surpass that of 1931.

Present Status of Television is Discussed by Dr. Goldsmith

ONE of the questions most frequently asked by projectionists everywhere—in letters to this publication, at organization meetings and even at social gatherings—is: "What about television? What about all this talk of 'television just around the corner' and 'in every home this Fall'?"

Probably the best explanation of the present status of television, at least so far as America is concerned, was advanced by Dr. A. N. Goldsmith, noted radio and sound picture engineer, in a recent address delivered before the Cleveland Chamber of Commerce and broadcast over a nationwide radio hook-up. That portion of the address relating to television, made available through the courtesy of Dr. Goldsmith, is appended hereto:

"There is some confusion of thought at this time between facsimile and television, and so one may be pardoned for first offering definitions of these two different fields.

"Facsimile broadcasting involves sending into the home, by radio, still pictures, drawings, and ordinary printed text, all this material appearing as a permanent record on sheets of paper. Television broadcasting, on the other hand, is the transmission by radio into the home of pictures or other material which may be at rest or in motion, and which is a transient image that is visible while it lasts but is not recorded. Facsimile is rather like a radio-controlled printing press;

(*Continued on page* 26)

ALUMINUM REFLECTING SURFACES FOR PROJECTION WORK

J. D. Edwards
ALUMINUM RESEARCH LABORATORIES

Aluminum is inherently a good reflector of radiation in the ultra-violet, visible, and infra-red portions of the spectrum. The steady development of aluminum reflecting surfaces on a commercial basis and their application to projection work is described in the accompanying paper, one of the most interesting contributions to the papers program of the last S. M. P. E. meeting.

ALUMINUM, the metal, is intrinsically bright. To make a good practical reflector from aluminum requires the solution of two problems: first, to develop suitable methods for bringing out or developing the inherent brightness of the metal; second, maintain the brightness of the reflecting surface under service conditions.

For brightening a metal surface, the obvious and time-honored expedient is to polish it. Where a specular surface is required this operation may be necessary, but it has certain limitations. With commercial aluminum sheet, about the best reflectivity that can be attained by polishing is of the order of 65 to 75 per cent. It is true that higher reflectivities, even up to 89 per cent, have been achieved by polishing some of the hardest aluminum alloys by a special technic, but such a reflecting surface can have only very limited application.

High Reflection Factor

Where a diffusing surface is satisfactory, chemical etching methods are very effective in bringing out the high reflecting power of aluminum. One such etching medium is an aqueous solution containing about 5 per cent sodium hydroxide and 4 per cent sodium fluoride. The surface is etched and brightened by immersion in this solution at a temperature of about 90°C. A final dip is given in a cold solution of nitric acid containing equal parts of concentrated nitric acid and water.

Using this method of etching, aluminum diffuse reflecting surfaces are being commercially produced, which have a reflection factor for visible light ranging from 82 to 87 per cent, and for ultra-violet radiation at a wavelength of 296.7 mμ of 81 to 82 per cent.

Fig. 1 shows a curve of the reflectivity of aluminum for wavelengths ranging from 0.2 to about 12μ. This curve represents values that are practically attainable, and is interesting for a number of reasons.

Aluminum, it will be seen, is an excellent reflector of ultra-violet radiation; it is unexcelled in this respect by any other metal. This characteristic is of special significance in the photographic art, because of the sensitivity of photographic film to short-wave radiation. The reflectivity of aluminum is nearly 90 per cent in the visible range, and attains values as great as 97 per cent in the infra-red range.

Having produced a surface of high reflectivity by the etching procedure just outlined, the problem remains of maintaining the surface against depreciation under severe service conditions. Indoors, where frequent cleaning is not required, etched reflectors of this type have proved highly satisfactory. Where they collect dust and dirt rapidly, however, or where they are subject to weathering, such a surface is not as readily cleanable as might be desired, and may show considerable surface attack when exposed continuously.

The surface can be protected with a clear, colorless lacquer, but only at a sacrifice of some 10 per cent in reflection. Outdoors, of course, the lacquer protection is relatively short-lived, and may become yellow and discolored if not carefully selected.

Another type of protection that is available is oxide coating of the aluminum surface. Electrolytic or anodic oxidation of aluminum, as typified by the *Alumilite* process, is a means of providing aluminum with a hard and abrasion-resisting coating of aluminum oxide. This coating is likewise highly impervious to moisture and is protective against weathering. An oxide coating, however, that is thick enough to confer all these properties in the desired degree decreases the reflectivity of the surface from about 10 to 20 per cent, and leaves the metal with a rather opaque and milky surface finish which naturally detracts from its value as a reflector.

Maintaining Bright Surfaces

A discovery of R. B. Mason of Aluminum Research Laboratories has solved in a highly satisfactory way the problem of producing bright aluminum surfaces and maintaining them under service conditions. The method is that of electrolytically brightening aluminum so as to bring out its maximum reflectivity. In this process, the aluminum reflector, formed to final size and shape, is made the anode in an electrolyte of novel composition, acting in which capacity the reflector is brightened by the electrolytic removal of impurities, both metallic and non-metallic, from the surface of the metal.

This process is unique in that the brightening is effected without any etch-

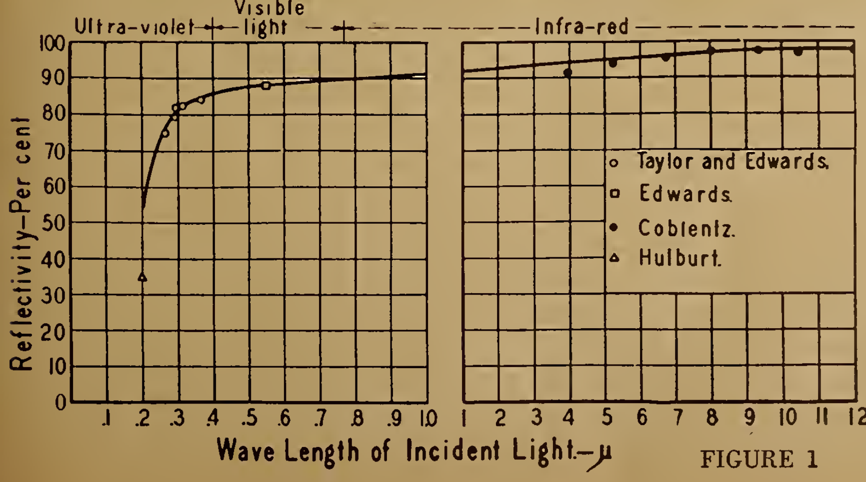

FIGURE 1

ing or roughening of the surface; thus, a highly polished reflector can be electrolytically brightened without appreciable loss of specularity. For example, a polished aluminum reflector having a reflection factor of 74 per cent, after being subjected to this electrolytic brightening treatment, had a reflection factor of 87 per cent. A very thin protective oxide film is formed upon the surface, but it is too thin to withstand many service conditions satisfactorily. Very fortunately, however, the electrolytically brightened surface can be further oxidized by the Alumilite process to give it a substantial protective coating of oxide without any important loss in reflectivity.

Specular reflectors having reflectivities of 80 to 85 per cent are being commercially produced by this process. Application of the final oxide film appears to cause a somewhat greater loss of reflection for ultra-violet and infra-red radiation than for visible light.

The trade-name *Alzak* has been applied to this process and to reflectors made by it. The process in outline consists first in preparing the surface by polishing or etching, depending upon whether a specular or diffusing surface is required. The surface is then electrolytically brightened and oxidized, whereupon it becomes a bright reflector having a clear, transparent oxide coat upon its surface. As a final treatment, the oxide-coated reflector is "sealed" so as to make the oxide coat impervious and resistant to staining or marking by handling or in service.

For the best results, aluminum sheet of special type and composition is selected for reflectors to be finished by the Alzak process. The Alzak reflectors have a smooth, hard, glassy surface which does not collect dirt and which can be readily cleaned by washing with soap and water. If a more thorough cleaning is necessary the use of a mild abrasive such as *Bon-Ami* is satisfactory and cleans without injury to the surface.

During the past year there has been an unusual interest in aluminum reflectors, both because of the development of the Alzak process and also because of the application of evaporated aluminum films to telescope reflectors. In this latter application, instead of preparing a highly reflecting surface upon aluminum, a very thin film of aluminum is deposited upon the glass or metal surface to be used as the reflector, producing what is known as a "first-surface mirror."

Aluminum normally has a boiling point at atmospheric pressure of about 1800°C. If, however, the pressure is reduced to a very low value, the boiling point is correspondingly reduced. For example, at a pressure of about 0.001 mm. of mercury the boiling point of aluminum is about 730°C, and at a pressure of 0.1 mm. is about 950°C. If, therefore, an object to be coated is suspended in a highly evacuated chamber, and aluminum contained therein is electrically heated to its boiling point, the aluminum will evaporate and be deposited as a bright metallic film upon any surface in the path of the stream of aluminum vapor.

Such films are apparently highly satisfactory for telescope reflectors because of their high reflectivity for the photosensitive ultra-violet radiation and also because of their non-tarnishing characteristics. Such films are not, however, able to withstand the handling or cleaning to which Alzak reflectors can be subjected nor are they weather-resistant.

Aluminum Screens?

Aluminum paint is another medium by which bright reflecting surfaces may be produced. It has been extensively used for motion picture projection screens. The reflection factors of aluminum-painted surfaces will vary from 60 to 75 per cent, depending upon the vehicle and upon the grade of aluminum bronze powder employed.

The smoothness of surface and diffusiveness can be controlled to some extent by proper formulation of the paint. Aluminum bronze powder is also available in the form of a paste, which, with a suitable vehicle, gives a bright and uniformly diffusing surface. The luster of an aluminum-painted screen adds "life" to the projected picture.

An important application of the Alzak process is in the production of lighting reflectors. The Alzak reflector has the advantages of lightness and non-breakability in addition to its high reflectivity and non-tarnishing characteristics. Aluminum reflectors can also be formed to the required shape, with the high precision that is necessary in some forms of projectors. Tests are under way to develop the possibilities of this process in preparing optically accurate reflecting surfaces, both small and large. It is too early, however, to make any prophecies as to what can be done in this very exacting field.

Another potential application of the Alzak process is in the production of small projection screens for home use. The bright aluminum surface made suitably diffusing presents an attractive background for the picture, and its lightness and ready washability are additional desirable characteristics. Other applications of bright metal trim and surfaces naturally suggest themselves. It is apparent that the motion picture industry may find many uses for these new products.

Discussion

MR. SANDVIK: What methods are used for polishing aluminum surfaces?

MR. EDWARDS: Aluminum reflectors are usually finished by buffing with "white diamond" or similar polishing compounds.

PRESIDENT GOLDSMITH: Do these two samples differ in their resistance to finger-marking, for example?

MR. EDWARDS: One is finished by buffing and the other is oxide-coated. The buffed sample will finger-mark readily. The other may show finger-marks, but they will wipe or wash off. You cannot satisfactorily remove them from the first reflector except by rebuffing.

PRESIDENT GOLDSMITH: The same distinction holds as well for the two etched reflectors?

MR. EDWARDS: Yes. You can tell the difference at once by running your finger over the surfaces; the oxide-coated surface has a smooth, glassy feeling.

MR. CRABTREE: What is the effect of gases present in the air, such as sulfur dioxide, sulfuric acid, hydrogen sulfide?

MR. EDWARDS: The oxide coatings are not resistant to high concentrations of many chemical reagents. We have had reflectors with the Alzak surface exposed to the New Kensington industrial atmos-

(*Continued on page* 23)

Newsreels Agree on Uniform Recording Standard

ALL newsreel companies have agreed upon an important change in recording practice which will result in better and more uniform sound quality in newsreel release prints. At present, each newsreel company records its sound without regard to the others, the tendency being to record sound at too high a volume or loudness level.

This difference in volume level, and particularly the tendency to record the newsreels too loud, has made it necessary for projectionists to reduce the volume of newsreels. The quality of newsreel sound has likewise suffered through the distortions introduced by the loud recording.

The newsreel companies have now agreed to reduce the volume level of newsreels to a uniform standard, approximately the same as that commonly used in the making of feature pictures. The adoption of this standard will materially improve newsreel sound quality by removing the present distortion. It will make unnecessary fader changes on the part of projectionists, and it will provide better sound quality at an appropriate loudness.

Beginning with the first run releases of March 4, 1935, all newsreel companies will start using the new standard, and continuing for several weeks film cans will be suitably labelled warning projectionists of the reduction in loudness.

PROJECTIONISTS EXTEND SOUND SYSTEM SERVICING

James J. Finn

THE battle against any extension of theatre servicing work by the electrics moved into its second phase during the past month when projectionist organizations, after a short period of preparation, went out and began active bidding on servicing operations. Reports from the most active sections indicate that much success attended these efforts.

Labor, and particularly the International parent body of projectionist and stagehand local unions, continued to manifest unceasing opposition to this new threat of encroachment upon its jurisdictional rights. I. A. president George E. Browne, in an exclusive statement to this publication, bluntly declared that not only will the I. A. continue its opposition to any extension of theatre servicing work by other than its members but it may also invoke its right to bar from projection rooms and stages all non-Union workers.

Dealer Opposition Stiffens

James J. Finn, editor of International Projectionist, completed a 5,000-mile tour of all the important centres east of the Mississippi during which, with the official approval and aid of the I. A. General Office, he assisted various local unions in launching theatre servicing operations.

Supply dealers throughout the country continued their bombardment of legislators in Washington and elsewhere with requests for a sweeping investigation of the activities of the American Telephone & Telegraph Co. in and outside the communications fields, with particular emphasis on the activities of A. T. & T. subsidiaries (Western Electric and Erpi) in the motion picture field and elsewhere. Ample funds were assured the Washington probe through approval by the Senate of a $750,000 expense budget for the investigating committee. In addition, the supply dealers furthered their campaign of education among exhibitors in every locality.

Erpi Maintains Silence

The most surprising development of the month was the continued silence of Erpi in the face of widespread criticism by all branches of the exhibition field. Just prior to the recent M.P.T.O.A. annual convention in New Orleans there was released to the trade papers an advertisement inviting exhibitors to visit the Erpi booths at the convention and familiarize themselves with the details of the new Erpi servicing plan.

Apparently that which is a matter for open and extended oral discussion between Erpi representatives and exhibitors at New Orleans is a matter for the utmost secrecy in New York, home of Erpi's main office. The general impression throughout the trade is that Erpi is most reluctant to give formal expression through a written release to that which is the topic of glib oral expression in New Orleans.

Erpi continued to insist, however, that its new servicing plan would in no way interfere with the rights of Labor in the theatrical field, and its representatives were most emphatic in stating (orally, of course) that Erpi hadn't the slightest notion of entering the supply field through either the manufacture or distribution of equipment. These pronouncements failed completely to satisfy either Labor or the supply dealers, and Erpi's continued silence furthered the belief that the electrics' plans involved considerably more than mere "recommendations" on theatre operation and equipment.

Incidentally, an Erpi paper describing its new servicing plan which was originally scheduled for the New Orleans meeting was suddenly cancelled without explanation, thus tying-in nicely with the "nothing-to-hide" attitude of that company.

It is understood on very reliable authority that immediately following an announcement by I. A. Local 307 in Philadelphia that it was ready to assume general theatre servicing operations, Erpi granted a 20% reduction in costs of present servicing work to a selected group of exhibitors in that city. This report was impossible of verification.

Company Service Groups

The stand of RCA, detailed in these columns last month, remained unchanged, this organization apparently being content to pursue a policy of watchful waiting and careful checking of developments.

Another recent development stemming out of the expiration of electrics' servicing contracts is the policy of several of the larger circuits, Loew and Warner included, to set up and maintain their own sound servicing departments staffed with non-Union men. It was pointed out in Union circles that the substitution of one group of non-Union men for another, even though not employees of the electrics, represented no advance at all from the standpoint of Labor.

Two I. A. Locals granted temporary working permits to several service men,

I. A. President Browne on Servicing

"As President of the International Alliance I not only advocate but will insist that all projection room and stage servicing work be done by Alliance members. Although no formal representations that any group contemplates action tending to endanger the jurisdictional rights of Alliance members working in theatres have been forthcoming, a restatement at this time, in advance of any untoward occurrences of traditional Alliance policy obviously will serve to prevent any misunderstanding as to the Alliance position in this matter.

"The Alliance is observing closely and with considerable interest the development of current theatre servicing activities, particuarly with respect to the security of its members.

"The diligence and concern for the welfare of the craft exhibited by 'International Projectionist' in this and other important matters should be a source of satisfaction to and win the approval of all members of the craft."

GEORGE E. BROWNE
President, I.A.T.S.E. & M.P.M.O.U.

with and without electric affiliation, thus bringing these workers under the jurisdiction of the Union. This policy is frowned on by the General Office of the I. A. no less than is that of major exhibitors in maintaining their own service staffs.

Sentiment was rapidly growing within Alliance ranks favorable to the establishment in the General Office of a Technical Bureau, headed by an acknowledged technical expert from I. A. ranks, which would handle completely all general servicing activities by affiliated local unions and, as, if and when this job was completed, would interest itself in furthering educational work among the locals. This plan has the endorsement of many outstanding members of the Alliance.

I. P. records show that more than 100 I. A. locals are now either actively engaged in servicing operations or are preparing to assume such work. As was to be expected, the larger locals, possessed of greater resources and more extensive experience, are leading the way in this campaign to protect the interests of Labor in the theatrical field. The smaller cities and towns undoubtedly will take their cue from and profit by the experiences of the large cities.

St. Louis Local Union 143 cooperated magnificently with the craft by making available to I. P. a complete set of charts, schematic diagrams and technical data covering almost every conceivable unit of sound reproducing equipment, prepared by that organization at a total cost of more than $7,000. Arrangements for distributing this data to the organized craft are now in progress.

Questions of Procedure

While all I. A. locals are unanimous in approving the assumption of servicing work by Union labor, there exists not a little difference of opinion as to procedure, particularly with respect to costs. In these columns last month were discussed four angles of the Local Union servicing problem:

1. Charges to exhibitors.
2. Existing service contracts.
3. Competency.
4. Proper service equipment.

On the question of charges, it seems pretty generally agreed within the craft that service work should be paid for by the exhibitor. As has been pointed out in these columns, the electrics cannot possibly afford to give service for nothing. but must get a price that will be consistent with executive and field work overhead charges. Local unions certainly can underbid the electrics, however, no matter how low the latter's charges may be scaled.

Existing service contracts are not a matter of primary concern on the part of local unions, except that their expiration dates should be carefully catalogued by the Union and overtures made to the exhibitor far enough in advance of expiration.

Competency is something which needs no special emphasis herein, and the angle of proper service equipment ties-in nicely here. The necessity for doing a good job, at least as good a job as done heretofore by the electrics, is taken for granted by all concerned. This consideration should offer no serious trouble to local unions, particularly in view of the fact that electrics' servicing to date has consisted largely of one call per week per theatre, or less.

Projectionist organizations naturally would enjoy the added advantage of having constantly in the theatre one of their members who could cooperate with and aid the Union serviceman at every point.

Nature of Servicing Contract

One important consideration not previously discussed concerns the nature of the servicing agreement to be executed between the Union and an exhibitor. This publication advocates that servicing operations by a Union, wherever possible, be made an integral part of the Labor contract for the one- or two-year period, or whatever the term. In this way there would be no misunderstanding as to just what was expected from both Union and exhibitor.

Not included in the foregoing summary of servicing requisites but none the less important is the evident desirability of a broad national plan for projection and sound servicing work by Local Unions. This may not be too long deferred, according to present indications.

Details of servicing activities by the various projectionist organizations are not included herein for obvious reasons, but advices from the field on their experiences to date in this connection are invited. Inquiries relative to any phase of projectionist servicing may be directed to International Projectionist, which will service these requests as fast as its facilities permit.

Thank You !

Editor, I.P.

Sir: We certainly want to compliment you upon the stand you are taking in behalf of projectionists and supply dealers relative to the electrics' entry into general theatre servicing. We know through personal contact with projectionists that they are with you to a man in your resistance to the electrics encroaching on their field.

You have gained enormous prestige in this section, and undoubtedly throughout the country, by your fearless battling in this respect, and this cannot but help make your publication even more important than it is now.

W. G. Preddy Theatre Supply Co.
San Francisco, Calif.

Strange Happenings in New Orleans

GRANTED that almost anything can and usually does happen in New Orleans, the appended news items relating to happenings at the M. P. T. O. A. convention in that city are of more than passing interest. From the *Film Daily* we cull the following:

> "Labor provisions of the code have brought about a new friendly attitude between operators and exhibitors owing to the hard-and-fast rules they lay down, declared Jack Miller in addressing the M.P.T.O.A. convention. He complimented Sol A. Rosenblatt for his administration of the code."

This from Mr. Miller who in 1933 strode through Washington hotel lobbies breathing fire and defiance against all codes, administrators, and particularly Unions, and whose every waking day since then has been filled with misgivings about "code sell-outs" and code labor provisions that were "damnable" and constituted only a "half-baked promise that was never meant to be kept."

So much for Mr. Miller.

By the Bayous

As is generally known, Paramount owes Erpi great gobs of money, so much so that Erpi exerted potent influence in the reorganization plans for that company. Now, Erpi had scheduled for the New Orleans exhibitor conclave a paper detailing their new all-inclusive service plan. The paper was withdrawn suddenly. Along came Mr. J. T. Knight of Paramount whose paper on "Air Conditioning" is reported in *Film Daily* as follows:

> "Since everyone is turning out equipment and plans furnished by a sales organization which are not those of competent engineers studying the particular problem of each theatre, he (Knight) advised going slow with air conditioning, dealing with reputable firms and checking plans with a competent engineer. He attacked high-pressure sales methods and warned that defective conditioning in homes and stores may cause sickness which will automatically hurt theatres with air conditioning. He suggested that the same branch ought to take over all theatre problems so that exhibitors could have reliable advice. He suggested a motion picture academy of engineers."

Very reminiscent are such phrases as "competent engineers," and "reputable firms," and "take over all theatre problems," and "reliable advice." Erpi was entirely justified in withdrawing its own paper. Mr. Knight did nobly by them.

Strange things happen in New Orleans.

WHAT THE I. A. SAYS—

The General Executive Board of the I. A. will insist, without qualification, that the work (servicing of projection and sound equipment) be maintained by the members of its Locals.

SOONER OR LATER—

Every projectionist will have to assume responsibility for the servicing of all projection and sound equipment under his care. Therefore, the following announcement should be of vital importance to you.

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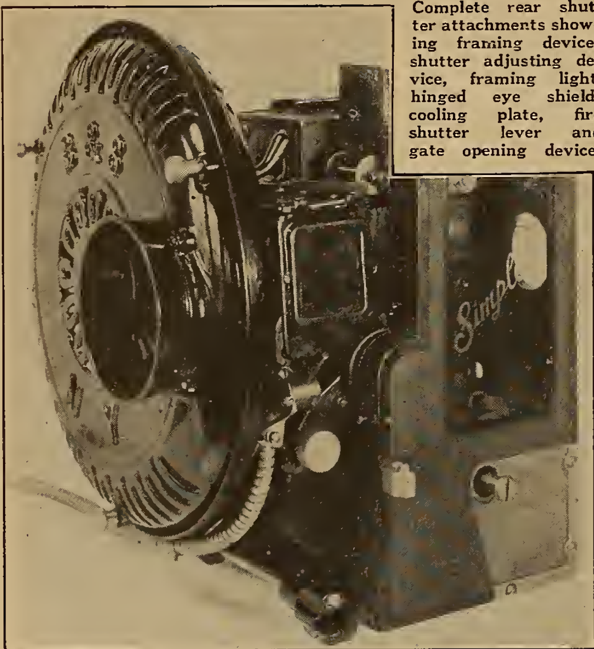

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Aperture Heat: 1250° F.

With B. & S. Rear Shutter

Aperture Heat: 340° to 350° F.

Installation can be made in one hour on any single- or double-bearing projector mechanism, without any cutting or drilling. Periodic oiling is the only maintenance requirement. Rear shutter equipment includes cooling plate, framing device, shutter timing adjustment, and a framing light. A hinged eye shield permits easy accessibility to the mechanism.

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NEW SERVICING PLAN AN OLD 'RACKET' WITH NEW TWIST

J. E. Robin

PRESIDENT, INDEPENDENT THEATRE SUPPLY DEALERS ASSOCIATION

THE history of the motion picture business is spotted with records of one battle after another waged in the cause of independence. Various groups at different times have endeavored to monopolize some branch of the industry —including production, distribution and exhibition—but through the years there have been many who were willing to voice their opinions and wage a battle for independence.

We who witnessed the formation of the Biograph Company and later watched the terrific battle waged by this company with the Edison interests were also privileged to watch the development of the Motion Picture Patents Co. and the General Film Co. affiliations.

During this period exhibitors were compelled to pay a royalty of $2 weekly for the exhibition of licensed film, and the manufacturers of projection machines came under the domination of the Patents Company which instituted a system whereby all projectors carried a license plate which cost manufacturers $5 on each machine. Eventually, the buyers paid this charge also—a not inconsiderable percentage of the total cost.

The policies adopted by those groups which today are seeking to foist monopoly on this field differ but little from the old-time methods. The tactics employed never change, and the early stages of every such game have the same goal—to lull the exhibitor into a sense of security and anticipation that he is about to get "something for nothing," as at present advertised by the electrics.

When sound pictures were introduced Erpi had the field pretty much to itself. Soon RCA came along to provide some element of competition. Naturally, sound pictures effected radical changes in methods, operation and equipment. Everybody concentrated on sound reproduction, and visual projection was virtually ignored. Only the perserverance of manufacturers, in cooperation with supply dealers, kept alive any interest in visual projection. The electrics' juggernaut was rolling along, sweeping all before it by reason of $40,000 sound installations for simple equipment originally designed for public address work and $40 weekly service charges—*per theatre*.

Visual projection has now come back with a bang—thanks to the manufacturers and dealers. It wasn't until recently that the electrics, sensing that the sound equipment racket was about played out, suddenly bestirred themselves to take an interest in the visual projection end of the business—about which they knew nothing, to which they had contributed nothing, and which undoubtedly appeals to them only as a means of perpetuating their top-heavy executive and "service" mob in this field.

Statements to the effect that some such service plan is needed in this field to fill an existing gap are, in our opinion, propaganda. Allusions to the "service ideal" and "good will building" are so much hooey to cloak the real intent of the new servicing plan. Where was all this spirit of "good will" during the years when outrageous prices for sound equipment and excessive service charges were milking the exhibition field dry?

Supply dealers have a much better argument against servicing by the electrics than merely a desire to protect their own interests. Who is there in the motion picture business who remembers with any pleasure the policies pursued by the electrics from 1927 to date? Who in this field, mindful of the electrics' policies since 1927, is not wholly justified in expecting precisely the same sort of thing in 1935?

Where is there to be found today an exhibitor who, only recently released from the clutches of an electrics' ten-year servicing contract, is willing to go right back for another dose? Where is the supply dealer—or, for that matter, the manufacturer—who, remembering the policies of the electrics on supplies and equipment since 1927, is willing that they should now sneak in the back door?

Where is the projectionist today who, mindful of the activities of the electrics' servicemen since 1927, would welcome any extension of their influence?

There is no such supply dealer, or manufacturer, or exhibitor, or projectionist, because their memories of 1927 and thereafter are too fresh. Any projectionist not in opposition to this new electrics' servicing plan might just as well seek a job as a teamster, or conductor, or common laborer.

The money which the electrics seek through the operation of their new servicing plan has to come from somewhere, and that somewhere is from Labor, from supply dealers and from manufacturers.

Since the electrics are so very much interested in creating "good will" for their products, why not amass tons of good will by immediately eliminating all *compulsory* service charges and by further reducing the cost of existing *voluntary* service agreements? It cannot be denied that there is intense opposition to these charges—so why not begin at this point?

The reaction of Congressional representatives to the appeal from supply dealers and projectionists for cooperation in the fight against domination of this field by the electrics has been most gratifying, and it is with great pleasure that we note the allotment of a large sum of money to enable a thorough investigation of the electrics' activities in the picture field.

The servicing of equipment in the theatre—and particularly in the projection room and on the stage—should be strictly under the supervision of local projectionists and stagehands, whose patronage should be given to established supply dealers. Cooperation between supply houses and Labor in this respect will make it virtually impossible for the electrics, or anybody else, to exercise domination over this field.

I. A. TAKES OVER LOCAL 110 FOLLOWING SLAYING OF MALOY, UNION LEADER

CONTROL of Local Union 110 of Chicago, second largest projectionist group in the Alliance, was taken over by the I. A. immediately following the recent killing (Feb. 4) of Thomas E. Maloy, for years the business representative and virtual dictator of Chicago projectionists.

Maloy's passing from the Chicago scene was as dramatic as his long Labor career was sensational. The best reports available state that a small sedan in which two men drove alongside the large Packard closed car in which Maloy was riding from his home to his office and riddled the labor leader with shotgun slugs, in addition to one effective shot from a .45 calibre revolver.

Maloy's friend for many years and constant companion, Dr. Emmett Quinn, who was riding up front with Maloy, miraculously escaped injury. Police pondered the fact that while the shots which killed Maloy entered the left rear glass door of his sedan at an acute angle, the windshield was unbroken.

The killing, one of the most sensational incidents in Chicago's long list of crime, induced eight-column heads of incredible depth in all Chicago newspapers, while

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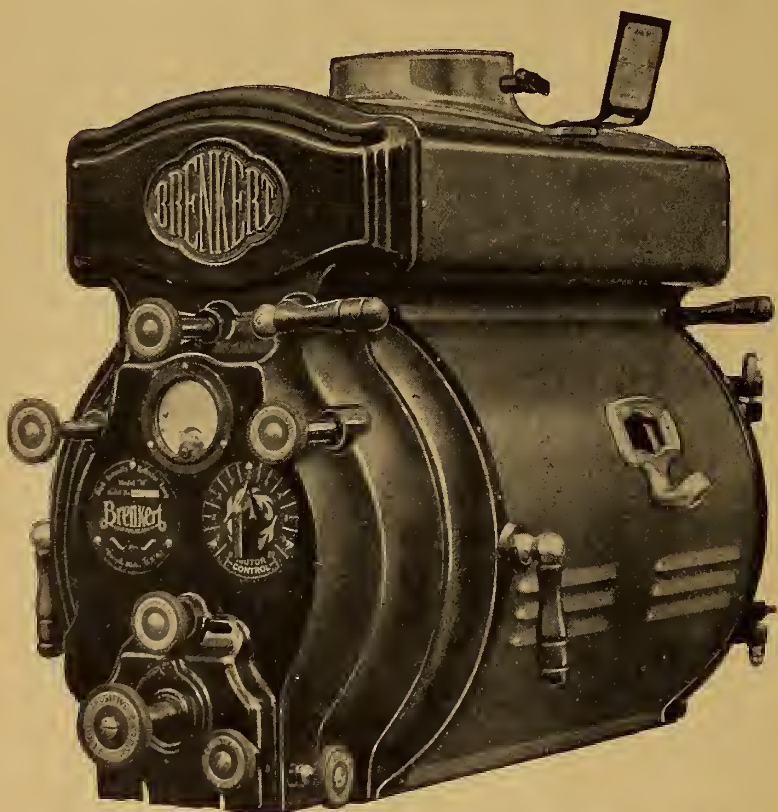

- Wide range feed regulation with separate negative feed adjustment permits operating this lamp at 34 to 65 amperes with positive Suprex carbons of 6-mm., 7-mm., and 8-mm. diameter.
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the story in abbreviated fashion was carried over every press association network in the country. Newspaper demands that Maloy's killers be found caused considerable police activity, but to no avail.

At the time of his death Maloy was embroiled with the Government over alleged income tax discrepancies, and it was generally known that the case had been going strongly against the labor leader. The day preceding the killing the *Chicago Tribune* carried a short item to the effect that the case against Maloy had been indefinitely postponed, with the stipulation that it could be reinstated upon five days notice.

Assumption of control over Local 110 gave the I. A. direction of the two largest projectionist units in the Alliance, New York Local 306 having been in I. A. hands since July, 1934. The Pittsburgh Local Union is also under I. A. direction, but is expected to be given full local autonomy shortly.

Besieged by Chicago newspapers for a statement relative to his reasons for taking over Local 110 and his plans for its future, I. A. President George E. Browne said only that the newspapers themselves had explained his action. By this he referred to the sensational series of press articles which ran every day for a week following Maloy's death, included among which were the following charges:

1. That racketeers were active in the affairs of Local 110.
2. That several "favored sons" were alloted jobs paying as high as $130 weekly in theatres where they had never been, the actual work being done by another projectionist who received but an infinitesimal amount of the regular salary.
3. That hordes of non-members of Local 110 were working in theatres on a temporary "permit" basis.
4. That the regular membership had long been oppressed, intimidated and assessed out of all proportion to the normal expenses of the Union.
5. That "deals" involving staggering sums had been made with exhibitors to the detriment of the Union members.

Beyond this brief statement Browne refused to go, except to say that all necessary steps to protect the interests of the general membership of Local 110, including an audit of its accounts to date, would be taken.

Only a day passed before the Browne program was instituted with sweeping effectiveness. Harland Holmden, I. A. vice-president and leader of Cleveland projectionist Local 160, was installed as director of Local 110 affairs, being called from a similar post in New York Local 306. After launching a minute audit of Local 110 books, Browne proceeded to remove the "favored sons" from their

jobs and to eliminate all floating "permit" men.

Preceding this overhauling job, Browne requested and obtained the resignation of every elected and appointed official of Local 110.

Holmden will continue to direct the actual operations of the Chicago Local, it is understood, dividing his time between that city and New York, where Local 306 still presents many pressing problems.

Browne Statement to I. P.

Although uncommunicative to the daily newspapers, President Browne, in an exclusive special statement to INTERNATIONAL PROJECTIONIST, said:

"That action which the I. A. has taken in connection with Chicago Local 110 is consistent with previous similar actions—in New York, Pittsburgh and elsewhere. To the General Office it brings merely another difficult and nasty mess, one that will require unlimited sweating and the complete cooperation of all Local 110 members before it is cleaned up.

"However, the matter has larger implications than merely another hard job for Alliance officials. What of the effects of this situation upon the thousands of Alliance members throughout the country and in Canada? How many more such blows to their prestige and standing in their respective communities can these members endure? The answer is simple—none.

"For this reason, Alliance officials are determined that there must be no recurrence of such situations, and that Local Unions must be so conducted that they will reflect credit upon themselves and the Alliance. I know of no Labor organization today that isn't badly in need of favorable public opinion."

RCA CONSOLIDATION

The RCA Victor Co. and the RCA Radiotron Co., the two wholly owned manufacturing subsidiaries of the Radio Corporation of America, have been consolidated into a single organization to be known as "RCA Manufacturing Co., Inc." The new Company will begin operations as of January 1st, 1935. The consolidation is being made primarily for convenience of operation.

The present trade-marks on the products manufactured will be continued through the establishment in the RCA Manufacturing Co., Inc. of two divisions, which will be known as the "RCA Victor Division" and "RCA Radiotron Division."

ALUMINUM REFLECTORS FOR PROJECTION WORK

(*Continued from page* 16)

phere for a period of over a year with no loss of reflection factor. When brought into the laboratory and washed, they exhibited their original reflection. They will, of course, collect dirt.

MR. CRABTREE: How does the reflection factor of a lamp reflector fall off under practical conditions without cleaning? Is the loss of reflective power due entirely to dirt?

MR. EDWARDS: In the case of the Alzak aluminum reflector it is due almost entirely to dirt. In one case I know of, measurements were made on a silver-plated reflector and an Alzak reflector; the silver-plated reflector had been plated and polished three or four days before. Measurements were made of the two, and they were then cleaned and re-measured. There was no increase or decrease in reflection of the Alzak reflector, but cleaning increased that of the silver-plated re-

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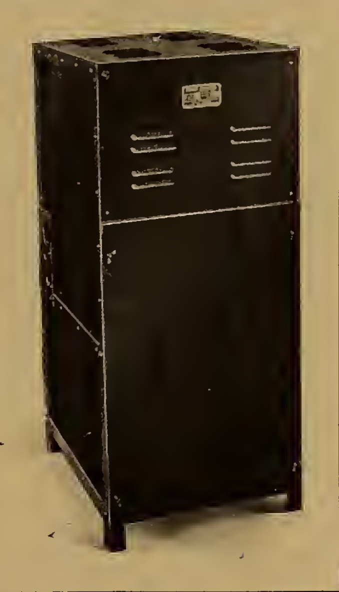

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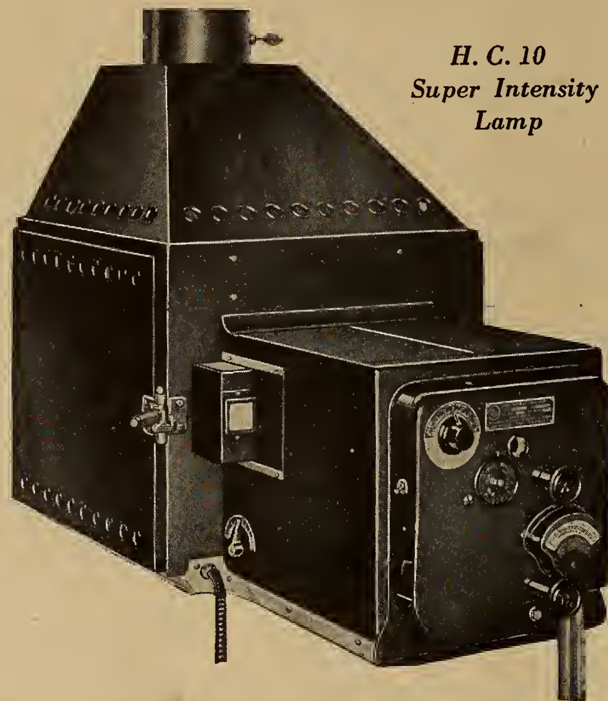

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flector by 5 or 6 per cent, showing the depreciation that had taken place in a matter of three or four days. Aluminum is not darkened by sulfides as is silver.

MR. FRIED: In the production of motion picture screens, can you control the diffusion characteristics very accurately?

MR. EDWARDS: Only approximately.

MR. JOY: How high a temperature can the reflector withstand without becoming discolored?

MR. EDWARDS: In some of our experimental work the temperature of the reflector surface was about 320°F. over quite an extended period. There was no depreciation.

MR. JOY: Have you done any work at say 200°C.?

MR. EDWARDS: Some experiments have been reported in which Alzak reflectors were heated in an oven for 500 hours at 250°C. with only a small loss of reflectivity.

MR. DAY: How large sheets can you handle now, particularly in the anodic treatment?

MR. EDWARDS: We have only a small plant at New Kensington for the Alzak process, but we have coated sheets about three feet square.

MR. DAY: Have you attempted 10×12 feet?

MR. EDWARDS: Not yet; but it is possible if you have the tank equipment for it.

MR. PALMER: Can you make as good a reflector by the vaporization process as you can by the anodic process?

MR. EDWARDS: My knowledge of the vaporization process is second-hand, but I have a reflector made on glass that has a reflection factor of 90 per cent. I have seen what I thought were reliable measurements going even above that, say, 92 per cent. You can make a better reflecting surface by that process than by the Alzak process. However, it will not withstand the service conditions that this Alzak reflector will, because of the thin, necessarily soft, film of aluminum. But it is very serviceable on the reflector of an astronomical telescope. This surface would be of particular value in stellar photography where you have the high reflection factor of aluminum for ultraviolet light, giving an increased sensitivity in photographically recording the light from the stars.

MR. RAVEN: Have tests been made showing the reflection factor and diffusion characteristics of this finish on flat sheets? If so, how does it compare with the surfaces we now use for motion picture screens? Also, would it be difficult to keep a screen with this finish clean and efficient?

MR. EDWARDS: Maintenance would be relatively easy. Any ordinary kind of dirt is readily removed by washing with soap and water, and the surface will dry free from water-marks.

MR. RAVEN: In other words, ordinary washing would restore the surface to practically its original condition?

MR. EDWARDS: There would be no difficulty whatever.

MR. GAGE: I have had the good for-

tune to see this process of evaporating aluminum on glass. It is done at the Physical Laboratory of Cornell University by Robley C. Williams. If you start with a good, smooth glass surface, you can get a most excellent coat of aluminum. However, there is no advantage in coating the aluminum so thickly that you can not see the filament of an incandescent lamp through it. The coating can be made so permanent that you can scrub the aluminum coat with cheese cloth, for perhaps 500 times, just as hard as possible, without apparently injuring the surface. This extra durability is secured by first evaporating a thin layer of chromium on hard Corning borosilicate glass followed immediately by a layer of aluminum which is hardened by washing in tap water, alcohol, or by condensed breath moisture.

Heat-Resisting Ability

How much heat can the all-aluminum reflectors withstand? That is probably a matter that is exciting considerable interest at the present time among the projection engineers. As we know, the back-surface silvered glass reflector will not stand heat above a temperature at which the backing breaks down. We shellac the surface and gain a certain resistance to heat, which is small. If the back of the silver is copper-plated and we use a high-grade varnish, then we can use higher temperatures.

Mr. Edwards: I cannot say just what temperature can be withstood without depreciation. The aluminum oxide on the surface is not easily discolored by heat. When the metal and oxide have been stretched sufficiently by thermal expansion, hairline cracks appear. They do not injure the reflection efficiency of the surface appreciably, and are so fine that they can not be seen when viewed dirctly. The light must be almost at the angle of gazing incidence in order to see them. Our hopes, at least, are that reflectors of this type will stand reasonably high operating temperatures, and do so very satisfactorily.

Mr. Mitchell: Have you any comparative data on the reflection characteristics of chromium, for instance, and this new finish?

Mr. Edwards: The data I have seen from Nela Park indicate that chrome plate has a reflection factor of the order of 60 to 65 per cent; with the new finish the reflection may be 80 to 85 per cent.

Cameron Servicing Book Endorsed by I. P.

WE HAVE just seen an unbound copy of the new second edition of "Servicing Sound Motion Picture Equipment," by James R. Cameron, which will be published shortly. This book is both timely and interesting, the former because it coincides with current activity by International Projectionist to spur projectionist servicing, and the latter because it presents several innovations in projection book publishing.

This new book is much larger in size and number of pages than former editions, yet it is much lower in price and constitutes a very worthwhile investment of a comparatively small sum.

Unique Trouble Charts

Among the many new features is a "trouble-shooting" section, with which is tied-in a series of servicing charts which alone are worth the price of the book. Practically every sound equipment trouble can be located immediately through use of these charts. Each unit is covered individually, and a clever index enables even a ten-year old boy to quickly find any particular trouble, the remedy for which is clearly outlined. More than 300 sound reproducer equipment troubles are catalogued in this way.

Innumerable wiring diagrams, sure to be of great help to projectionists in servicing work, add further value to the sound section.

The visual projection section matches the sound section in amount and quality of contents, and is probably the most comprehensive effort by Cameron to date. The up-to-the-minute character of the work as a whole is evidenced by the inclusion of detailed information on copper-oxide rectifiers, introduced in this field only within the past month.

The liberal sales policy of the Cameron Publishing Co. places this book within reach of all projectionists. The book is sold on the basis of complete

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INTERNATIONAL PROJECTIONIST endorses unqualifiedly this new Cameron book and recommends it to projectionists everywhere.—J. J. F.

TELEVISION PROBLEMS CITED BY DR. GOLDSMITH

(*Continued from page* 14)

while television resembles a radio-transmitted motion picture.

"If this distinction is kept in mind, it becomes obvious that entirely different services will be offered to the public by facsimile broadcasting and by television broadcasting respectively. It may be added that facsimile broadcasting is the less difficult art and that it offers fewer serious commercial obstacles to its successful exploitation.

A Radio Printing Press

"If you will permit your imagination to roam for a moment, you will probably agree that ultimately facsimile broadcasting will prove a service of considerable popularity with the general public. Anything which is included today in magazines, newspapers or other printed material, will sooner or later be capable of speedy and accurate transmission, instantaneously, into a multitude of homes provided with simple and attractive, automatically-functioning receiving equipment. Truly, this device may prove the

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radio printing press of the future and may, in time, have as profound an influence on our life and customs as has had the printing press.

"Television broadcasting is, by its nature, more spectacular than facsimile broadcasting. The thought that pictures in motion can be transmitted by radio into the home, together with their accompanying and synchronized sound, is indeed an attractive one; and we may all be pardoned for a certain impatience that this new agency of mass entertainment has not yet been commercialized on a large scale. However, *the matter is not so simple as it first appears.*

Problems Facing Television

"On the technical side, amazing progress has indeed been made toward practical television transmitting and receiving equipment. I cannot refrain at this point from paying some tribute to the research workers and development engineers who have valiantly struggled with the well-nigh insuperable problems of television over the last ten years or more.

"In a general way it may be stated that the problems of telephone broadcasting, as we know it today, are not one-tenth as difficult as those of television—and perhaps the fraction just mentioned should be one-hundredth! These workers have certainly accomplished a great deal; and television equipment in some of its branches is in a fair state of advanced development.

"But at this point, it becomes urgently necessary to temper our optimism and to introduce a note of restraint and qualification in discussing the future of television broadcasting. We must consider other problems of television besides the transmitter and receiver; and we certainly must give full weight to any economic obstacles which stand in the way of the early exploitation of television.

"What are some of the other problems of television?

"One of them is the difficulty of securing the necessary supply of programs and artists. We all know that Hollywood, with considerable difficulty, secures the necessary hundreds of stories each year which are put into the form of feature pictures. Is there any likelihood that radio television can secure more hundreds or even thousands of acceptable stories or plots around which acceptable programs can be built? Again, Hollywood retains, at allegedly vast salaries, that limited group of actors and actresses who have both eye and ear appeal. How scant the acceptable supply actually is has been repeatedly emphasized by the chief motion picture producers.

"Television faces this same problem, but probably without the means to expend the necessary large sums. Then too, even supposing that program material and artists were available, where shall be found those ultra-prosperous advertising sponsors of the programs who can afford to pay a substantial portion of the cost of a feature-film production for an hour's broadcasting?

"Additional and formidable problems

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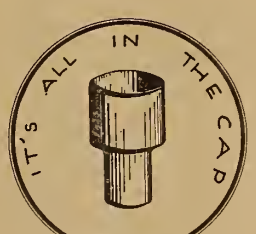

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loom up when some attempt is made to discover how television programs are to be carried simultaneously to the entire country, as is necessary for reasons of general appeal and for economic reasons as well. As it happens, the existing wire telephone lines are not capable of carrying television pictures. There would be required either an entirely new, elaborate and expensive wire system for the television transmission network, or else some sort of a radio-network system with a multitude of relaying stations, as they are called, to carry the program from one city to the next and so across the country.

Network Costs Tremendous

"The cost of such wire or radio syndication facilities for television turns out to be staggering, and there is in sight no known and suitable source of the funds necessary for the establishment of the network facilities, the outlet stations in the many cities, the new and complicated studio facilities, and the program and artistic resources necessary for consistent entertainment value.

"That these problems will be solved in time and in a wise fashion can hardly be doubted; but it is evident that in the interim we shall have to possess our souls of patience even though television has made encouraging technical progress."

NEW VISTAS IN SOUND TRANSMISSION

(*Continued from page* 12)

relief, that the three-dimensional character of music is greatly emphasized.

To illustrate: At a certain moment the music may be high and low and deep. In other words, some sounds will be high in pitch, others low in pitch, but another mass of sound may be markedly louder or softer than the first two groups, and so give the impression of being nearer or farther than the first two groups, thus bringing the dimension of *depth* to the total mass of sound.

In some ways this is like certain kinds of painting which have the two dimensions of a flat surface plus the third dimension of depth or relative planes of distance. In painting, this depth is sometimes the result of perspective, sometimes of almost magical subtleties of color relations.

In music, depth is often achieved through highly sensitive relations of loud and soft planes of sound. Depth in music can also be suggested through tone character.

Another type of depth or tonal perspective is achieved when the sound actually comes from right and left, high and lower, far and near—for example, when the violins on one side of an orchestra play an answering phrase to the cellos on the opposite side, or when a near

trumpet is answered softly by a distant trumpet.

Or again, in an important passage of oboe or muted trumpet, the high sounding harmonics which give the individual character and quality of tone to these two instruments can be increased in intensity during the duration of the solo. Or if the deepest sounds of the contrabass or organ pedal have a significant melodic outline, that part of the frequency range can be so intensified that the fundamental sounds of the melody and of the harmony above it will take on greater power and sonority. Or a middle voice in the orchestral fabric, such as the French horn or the cello can be brought out into high relief.

In other words, the potentialities of music, with reference to dynamic power and frequency, have reached new heights of plasticity and controlled power, never dreamed of as possible attainment.

Yet,—except for the aforementioned demonstration in Washington and in Philadelphia,—nothing has been done to give these new possibilities of sound to the vast music-loving public throughout the country. If a gold mine of great capacity were found, or a subterranean sea of petroleum were discovered, it would be quickly developed. But a means whereby Everyman can hear music with overwhelming beauty and eloquence in any part of our vast country, no matter how remote, is neglected and left unused in a laboratory.

New Transmission Vistas

Our standards of good orchestral tone, of the relations of individual instruments to each other, of groups or choirs of instruments to each other, of solo voices, of voices in chorus, and of all these above-mentioned voices and instruments sounding together,—as, for example, in opera,—have been built up by the memories and experience of the best performances we have heard—best as to singers, instrumentalists, instruments, acoustics, setting.

It may perhaps be a revolutionary and unwelcome idea to some that the definitions of sound and of tone that have held good for a long period no longer are able to limit the possibilities of music and sound. . .

What *is* the 'natural' sound of an orchestra? Some years ago there would have been many willing to answer the question in terms quite definite, but the enlarging conception of sound, and new possibilities of controlling and modifying it, inevitably lead us to distrust the certainties of years not long past.

The whole sphere of sound has become vastly freer. Those that know this to be true and realize the scientific basis for it become much more open-minded—and much more modest—because they know that *they do not know*, whereas those who are unwilling to depart from the safe certainties of an earlier era know only the dogmas which naturally grew out of a more limited experience than is now the privilege of the physicist and musician who is in intimate contact with, and has absorbed, the most recent experiments in sound and the broader conceptions and richer knowledge that are the birthright of everyone today.

It is not too much to say that wired transmission has opened possibilities that may ultimately revolutionize the whole world of music. Clearly it is for us to see that those possibilities are used not capriciously but with true artistic motiv-

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ation and discipline, not as an end in themselves but as a means to greater freedom and range in expression.

The facilities of wired transmission extend these possibilities enormously. Now they are really limited only by the intake of the human ear and by the brain centres to which the ear reports and in which the sensations of sound are received and in some mysterious way changed into emotion, mood, and states of being.

Electrical Production of Tone

We can listen to tone and music from a variety of sources—the human voice, musical instruments, space and wired radio, recorded music either by disk or by film, and electrically produced tone. When we listen to music from our radio set, the tone is produced by voices or instruments and then carried to us by a method we call broadcasting. But it is possible to produce the tone, not by voices or instruments but by new types of instruments which do not have bows and strings like those of the violin, or tubes of wood or metal like those of the wood-wind and brass instruments, but in which tone is produced by oscillators, which in principle vibrate like a tuning fork, or by sound waves imprinted on film, and by some other principles of which I am not yet at liberty to speak. The Theremin was one of the first of these instruments.

All of the various types of these instruments have means to control frequency, intensity, timbre, duration. Of course they are to be played by musicians, just as the violin or piano or any other instrument.

As the machine does more of the work that formerly we did by hand we shall all have more leisure. How shall we fill this free time with pleasure and self-development? Some will dissipate. Others will recreate.

I have a picture in my mind of great recreation centres where we might all go in our leisure hours and find opportunity for freedom and relaxation, whether in gay sport or in quiet study. These centres would be like large parks, some parts of which would have tall trees and gardens, others flat places for sports, others water for swimming and rowing and sailing. There could be theatres for drama, opera, cinema, *variete*. Restaurants to suit various tastes and needs. Museums and schools for adults, adolescents, children. Kindegartens and play schools for very young children, with nurses, educators, and psychologists who are sympathetic to children.

In one part of the gardens might be a high tower from which at night colored light would be diffused, which in time would create a new art of color in motion and form. From this tower music of several kinds might be sent out over this part of the gardens. Sometimes good jazz for dancing, sometimes gay music of the type of Sousa's marches, sometimes the highest kind of symphonic music. This music would be sent out at times of the day that would suit the majority. Perhaps every day two periods of jazz for dancing, both open-air and under cover; about three times a week the finest symphony concerts; at other times singers, violinists, pianists of the highest order.

The music could be sent out by wired transmission. The orchestra or other musicians would be in a large hall, so that those who like to see as well as hear music being made could be in this hall instead of in the gardens or covered parts of the gardens. The tower would be so high, and the loudness of the music so adjusted, that thousands could hear it in the gardens, either walking about or sitting. The music would be clear and full but not obtrusive. It could be directed to certain parts of the gardens, but be practically inaudible in others.

This could all be done because there is practically no limit, in wired transmission, to the control of loudness, tone-color, and the direction in which the music is sent.

Of course these recreation centres must not be profit-making, but each type of amusement should be as inexpensive as possible, and aim only to make cost and income equal. In other words, these recreation centres should try to supply us with the various kinds of amusement and recreation of mind and body which we all need, and which would give us all our share of the joy and poetry of life. . .

In broadcasting, two features are important—programme and technique. The standards for both are set, in the long run, by public taste. If the public steadily and firmly demands a higher average of quality in programmes, and transmitting and reception equipment that is *up to date*, both will be created. A few isolated individuals cannot bring this about. It is Everyman who must ask and who will receive.

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A. C. vs. D. C. Suprex Arcs; Lamp Conversion Jobs

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March 1935
Vol. 8 No. 3

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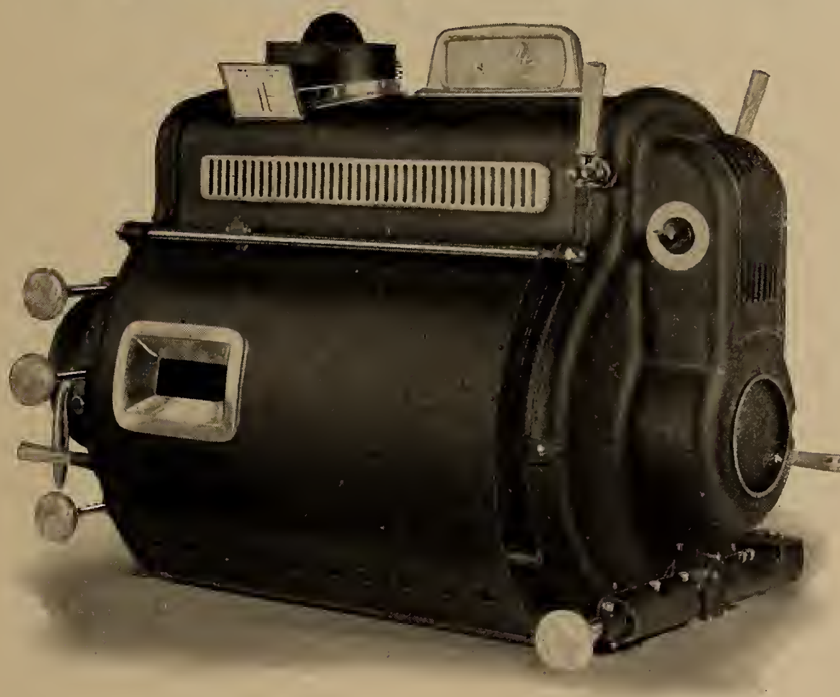

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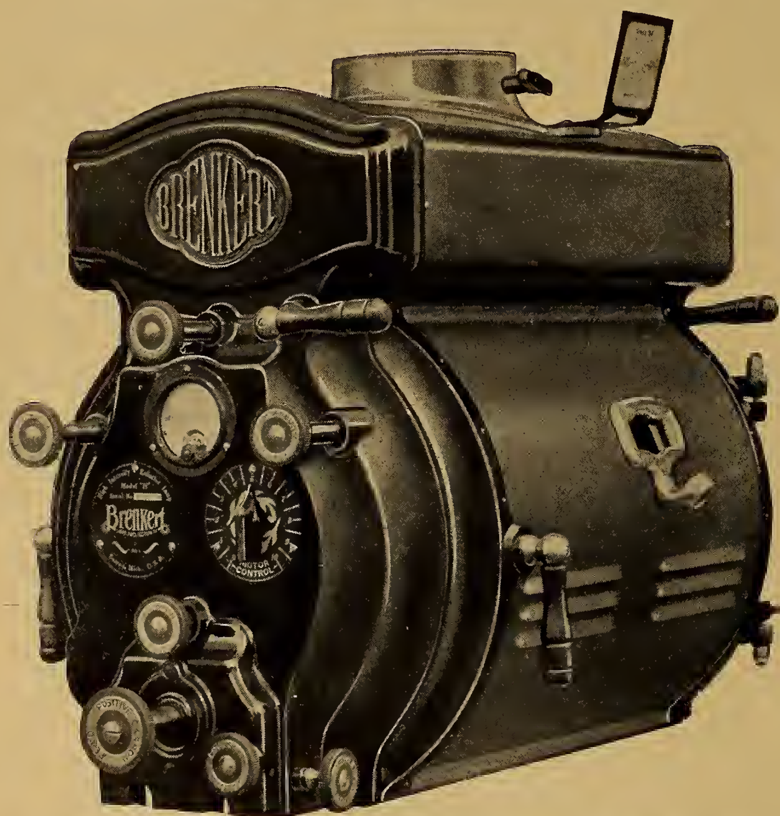

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LETTERS *from* Readers

PROJECTION "HINTS"

Various projectionists . . . have commented on the absence from I. P. of a section such as "Hints for the Projectionist." I believe that a column of this sort would enable many . . . to get better acquainted with the job you are doing.

JOSEPH BERTA, JR.
Bridgeport, Conn.

I. P. being crammed with "hints", short and long, anent projection, Mr. Berta might be a bit more specific. "Kink" and other such sections usually are not supported by the field. I. P. columns are always open for any worth while contribution, "kink" or otherwise.—ED.

CHEER SERVICE CAMPAIGN

Congratulations on the good work you are doing with regard to servicing work by projectionists instead of by the electrics. As a manufacturer I realize (and projectionists and dealers should also) that if the electrics' plan is allowed to go through without protest, all of us will be in the soup. It will simply mean the end of the small and independent business in this field and, finally, the substitution of present projectionists by the electrics' own hand-picked men.

I consider your campaign against electrics' a very fine thing for this field.

WENZEL COMPANY
Chicago, Illinois.

SOCIAL NEWS IS BUNK

. . . May I suggest that we see printed in I. P. more about the problems of projection booth than about the social life of some motion picture heads.

DAVID P. MARGARETICH
Madera, California.

Enterprising press agents for unions and labor leaders please take notice. And, Mr. Margaretich, the word is "room", not "booth."—ED.

2000-FOOT REEL SITUATION

I am enclosing two letters from M-G-M Los Angeles branch manager anent the 2000-foot reel situation. I have sought and been granted permission for you to use these letters, as I thought your readers might be interested.

. . . I admire the straightforward way you write your articles pertaining to the problems of the projectionist. I am 100% for you and I. P.

FRANK BRUENING
Lancaster, California.

Double (or 2000-foot) reel situation has been covered from all angles in I. P. No argument from craft or theatres that double reel isn't wholly desirable. At present a case of watchful waiting until distributors decide to spend large amount necessary to

(*Continued on page* 21)

APR-2 1935
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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 8 MARCH 1935 *Number 3*

Letters from Readers 4

Index and Monthly Chat 5

Equipment Necessary for Sound System Servicing 7
LEROY CHADBOURNE

More Bunk Concerning 1935 Status of Television 10
JAMES J. FINN

Step-By-Step Analysis of Sound Reproducing Equipment, VIII 11
AARON NADELL

Questions and Answers on Sound Projection 14

A Modern Method to Fight Tuberculosis 14
F. M. POTTENGER, M.D.

Copper-Oxide Rectifiers for Projection Arc Supply 15

The Answer to the Question: A. C. or D. C. Suprex Arc Operation? 16
ERNEST HOFFMAN & JAMES J. FINN

A Manufacturer's Views on L. I. Lamp Conversion 18
KARL BRENKERT

Some Problems of Motion Picture Engineering 19
DR. A. N. GOLDSMITH

Projectionists Score Wide Service Work Gains 20

News Notes

Technical Hints

Miscellaneous Items

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420

MONTHLY CHAT

THE "triumph" scored by the motion picture industry over the Tri-Ergon forces of darkness led by William Fox is best translated in terms of gains made by the lawyers for opposing sides. Here again the worst evils of patent racketeering were on display, with more than $500,000 having been expended by the defendants in the suits.

Labor unions, no less than others, have ample reason for giving lawyers a wide berth.

SEEMINGLY dead, the A. C. arc rises from its tomb through the medium of a spirited letter received in the editorial mail bag. Letter and answer are included herein and make for very interesting reading.

CITING the "complete and abject commercialization" of the daily press, the *Electrical Workers Journal* states: "Labor must continue to depend upon its own newspapers and magazines . . . If there ever was a time when labor should rally around its own newspapers and magazines, it is now." Amen.

NUMEROUS recent letters suggest the possibility of forming a national technical organization of projectionists. Correspondents point to the success attendant upon state projectionist organizations and suggest the welding of these groups into one national body.

Now, such a plan has long had our wholehearted support, despite the record of past failures in this direction. Surely the past five years have demonstrated the need for such an organization. But I. P. has neither the authority nor the resources to effect such an organization. If only a couple of existing state organizations would adopt strong favoring resolutions . . .

CONSIDER, for example, what great good such an organization could do in connection with current servicing activities by projectionists. Consider, too, the prestige that would accrue to projectionists by having organization committees pass on new equipment, legislation, etc. The possibilities of such an organization are limitless.

WHILE we are on the subject of sound reproduction, we mention the fact that there are some awful whoppers relative to extended frequency range reproduction being put into circulation. A bit of research on certain equipments might be a trifle embarrassing to the authors of these extravagant—if not actually misleading—claims.

MANY projectionists there are who will relish the news that the double, or 2000-foot reel, is scheduled to make its bow shortly. Many others there are who won't relish the news but will have to go through all the motions of liking it.

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EASTMAN *Super-Sensitive*

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INTERNATIONAL PROJECTIONIST

VOLUME VIII NUMBER 3

MARCH 1935

EQUIPMENT NECESSARY FOR SOUND SYSTEM SERVICING

Leroy Chadbourne

THE present widespread interest in projectionist servicing raises the question of servicing equipment to one of first importance. If the projectionist is to do a satisfactory servicing job, he must have the tools and equipment that up to the present have been used mainly by the service engineer.

The equipment listed herein will never be found in any one projection room. It is too expensive. Certain vital items must be found in every projection room. Others will have to be part of the normal kit of the visiting service projectionist. Still others, designated as "group instruments" will be needed only rarely, being rather costly, and will commonly be rented or borrowed only when the need for them arises.

Many makes of sound equipment require special tools or jigs, not listed here. Moreover, any person experienced in sound servicing will very likely want to modify any general list, adding to it items of equipment that he has found particularly useful or handy. With these limitations in mind, the list should prove useful to projectionists or groups of projectionists about to undertake servicing.

Necessary Meters

D.C. VOLTMETER. A multiple-scale d.c. voltmeter is vitally necessary for trouble-shooting and testing of all kinds. If there are storage batteries to be tested, the lowest scale should read from zero to at least 2.6 volts in tenths of a volt. The highest scale should be capable of reading the highest d.c. voltage used in the amplifier, which may be 300 or 1,000, according to the largest type of tubes used. One instrument can cover this range, but a meter that uses an external multiplier (resistance), for the higher voltages may prove less expensive.

Should be in every projection room.

D.C. AMMETER. The highest scale on this instrument need not read more than perhaps 10 amperes, but the lowest scale should reach 1 milliampere at least. The d.c. ammeter is used to test resistors for open circuit, short-circuit and correct resistance; condensers for short-circuit, and inductances and transformers for open-circuit.

A combination d.c. volt-ammeter is perhaps the least expensive form of the two meters just mentioned. Highly desirabl in every projection room; if not kept there, vitally necessary in the kit of th service projectionist.

D.C. MICRO-AMMETER. For reading photo-electric cell current. Useful in the kit of the service projectionist, or as "group instrument" the use of which can be obtained when desired.

A.C. VOLTMETER. For testing the filament voltage of a.c.-heated tubes and the plate voltage of rectifier tubes. The rectifier-type a.c. voltmeter with a multiple scale reading fractions of a volt can be used in place of the output meter mentioned subsequently, and it costs less. The sound output reading in volts can

be converted, if desired, into decibels by means of a simple conversion chart.

Should be in every service kit.

A.C. Ammeter. Used to test condensers for open-circuit and inductances and transformer windings for short-circuit. In the projection room or in the kit of the visiting service projectionist.

Ohmmeter. Invaluable for trouble-shooting, this instrument is essentially a d.c. milliammeter with a small, flashlight type dry cell mounted inside its case and changed periodically. An extremely compact and convenient instrument for tracing through circuits of all kinds. Necessary for tracing through sound inductances and sound transformers, or circuits containing them, on which test buzzers and trouble lamps must *never* be used.

Where economy is desired, the d.c. voltmeter and d.c. milliammeter can be used instead of the ohmmeter. Connect the voltmeter in parallel to a flashlight cell and the milliammeter in series with the cell. Current from the cell can then be sent, through the milliammeter, into the circuit or part to be tested, and the resistance of that circuit or part calculated by Ohm's Law. Obviously use of the ohmmeter, which reads resistance directly, is a much quicker and more convenient way of shooting trouble.

Should be in every projection room.

Analyzer. The analyzer is an instrument that combines all five of the meters previously mentioned, and in addition performs other work that none of them can do. The best way to buy these meters is in the form of an analyzer.

An analyzer is a small portable panel containing from one to six meters, and numerous switches by means of which even a single meter can be made to serve for d.c. or for a.c. (through a small copper-oxide rectifier), and to read a very wide variety of scales, from a milliamp or a microamp to a thousand volts or more.

In addition the face of the analyzer presents tube sockets capable of receiving any type of tube for which the instrument is made, and flexible cables ending in tube bases. Any tube in the sound system can be removed from its socket and plugged into the analyzer. A flexible cable with a suitable tube base at its end is then plugged into the vacant socket, and complete readings of the tube's performance, and of the performance of all its associated circuits, can be obtained by means of the analyzer meter.

No other instrument can find trouble as rapidly.

Moreover, the analyzer is a tube tester, showing whether new tubes have survived shipment safely and are up to snuff, and whether old ones are still fit to use or must be discarded. A set of test leads coming from the analyzer permit it to be used in place of any of the meters already described for testing resistors, condensers, inductances and transformer windings, or for checking through any circuit.

Because it is half a dozen instruments in one the analyzer cannot be used efficiently without a bit of practice, and may seem impossibly complicated at first glance. It is, in fact, a very simple tool, easy to understand and very easy to handle.

An analyzer deserves a place in every projection room, and will not cost particularly more than the combination of meters already mentioned. Visiting service projectionists should carry their test meters in the form of an analyzer.

Warning: some of the meters previously mentioned can be bought for as little as 75c. Don't use this kind: they have low internal resistance and may damage or ruin sound parts that are tested with them.

Output Meter. Measures sound volume in decibels. This meter is used in connection with a sound test reel. There is no other quick and convenient method for testing quality.

Other Test Equipment

The output meter and test reel not only show whether any sound system is working properly, but permit comparative tests of different makes of tubes, parts, or complete sound systems, without which the service projectionist cannot possibly offer those reliable recommendations with respect to purchasing which are logically a part of the responsibility of anyone who undertakes service work.

Necessary to the kit of every service projectionist, and should be in the projection room of every theatre that can possibly afford it.

Sound and Visual Test Reel. To be used with the output meter, or with the a.c. rectifier-type voltmeter which, as previously explained, may replace the output meter. It contains quality recording for ear test of sound results, for checking flutter and other flaws and for securing proper pointing of the speakers for even distribution. Carries special frequency recording for focussing exciting light. Carries vitally helpful patterns for checking screen results for unsteadiness, travel ghost and other flaws.

Should be in the kit of every service projectionist.

Film Loops. These are short loops of film carrying sound recording of one frequency. Useful for focussing exciting lamp and for creating continuous, single frequency sound that can run for a long time while speakers are repointed and distribution of sound is checked.

These inexpensive loops deserve a place in every projection room.

Test Records. Frequency recordings on disc, used with an output meter to test disc reproduction in the same way that the film is used to check film reproduction. Available at 33 1/3 and 78 rpm.

Necessary for every theatre that uses disc, and should be available to the visiting service projectionist as a group instrument.

Test-a-Lite. The trade name of a handy and inexpensive neon tester that will show whether any circuit of 100 volts or more is alive, and whether it is carrying a.c. or d.c. For quick trouble-shooting in power circuits, location of burnt-out fuse, etc. Replaces the trouble lamp and is safer. Belongs in every projection room.

Test Buzzer. Inexpensive, used to test through long lines to which no speech apparatus is connected. Handy for one man to use, since the buzzer can be heard and needs no watching. An inexpensive low-voltage buzzer or electric bell is taped to a dry cell or a flashlight cell, the assembly constituting one unit equipped with a pair of leads. The only tester that can stand rough handling. Should be in every projection room.

Headphones. Indispensable for checking through sound circuits when sound stops or volume is low. Do not use a telephone receiver or any low-resistance phone that will pass excessive current and possibly damage speech circuit apparatus. High-resistance headphones are inexpensive. For every projection room.

Group Instruments

Good servicing work occasionally requires special equipment for dealing with difficult or unusual troubles. Such equipment cannot be bought for every theatre, or even for every service man, but it should be available for use when needed if projectionist servicing is to compete in quality with other forms.

Calibrated Microphone and Ampli-

New Englanders, of Course

A recent issue of the General Bulletin listed a group of I. A. members prominent in the law, in medicine, in the theatre, in politics, and so on.

To I. P.'s offices recently there came a pamphlet written by John Griffiths, of Ansonia, Conn., entitled "What is Mass?", which advances a few pertinent reasons why one might differ with Einstein on the correct answer to this question. A review of Mr. Griffith's book, "Dynamic Ether," appeared in these columns recently.

Current book catalogues list a book, "Breezy Adventure," by Arthur Foley, member of Boston Local 182, which details that worthy's ramblings across half the world.

Thus the influence of I. P. upon its readers . . . (Who *did* that?)

FIER. The output meter checks every part of the sound system except the loud speakers. It is connected in the speaker circuit, and measures the power of that circuit, but it cannot measure the efficiency of the speakers in converting that power into sound. For this purpose a microphone is needed, and a second amplifier that will build up the microphone current until it is strong enough to operate the output meter.

The microphone and amplifier used for this purpose naturally must be calibrated; their own curve must be known if a speaker curve is to be drawn from them. The test reel is played as usual; the photo-cell output is amplified by the system amplifier and played through the screen speakers. The calibrated microphone picks up the sound, its output is amplified by the calibrated amplifier and read by the meter.

Since the performance of the sound system *up to* the speakers can be measured in the ordinary way, since the recording on the test reel is known and the test microphone and test amplifier have been previously calibrated, the only unknown factors in this test are the speakers and the house acoustics. The receiving microphone can be placed close to the speaker, or can be moved about the auditorium for acoustic tests.

This equipment is valuable for comparing different makes of speakers, or for dealing with difficult acoustic problems.

AUDIO-FREQUENCY OSCILLATOR. The test film creates audio-frequency current in the photo-cell, but poor results may be occasioned by poor exciting lamp focus, excessive vibration of the projector head, or by electrical conditions anywhere between the photo-cell and the speakers. In cases of serious and obstinate trouble it is sometimes valuable to test the amplifiers separately from the photo-cell and its associated equipment.

This can be done by means of a calibrated oscillator, which generates alternating current of any desired frequency and power, and feeds it directly to the amplifier to be tested. The action of the amplifier is then checked with the output meter. This test is valuable for comparing different makes of amplifiers. The oscillator delivers a wider variety of frequencies than does the test film, and therefore makes possible a closer check of frequency response.

Tools and Accessories

CARBON TETRACHLORIDE. For cleaning. Every projection room.

FRICTION TAPE. Every projection room.

JUNK BOX. A catch-all for nuts, bolts soldering lugs and other small parts. Every projection room.

KNIFE. For skinning insulation from wire. Every projection room.

LENS TISSUE. To clean lenses of sound optical train without scratching the glass or leaving lint. Every projection room.

MAGNIFIER. To examine disc needle points and exciter filaments. Every projection room.

PLIERS. "Gas" and "electricians" pliers; "long-nose" pliers to reach into difficult places to tighten a nut or hold a wire while it is being soldered: "diagonals" to cut off the tail of a soldered wire or to cut open a cable form in places that cannot be reached by the cutting side of the electricians' pliers.

RAGS. For cleaning. Every projection room.

RUBBER TAPE. Every projection room.

SANDPAPER. Several grades, from coarse to very fine, for cleaning contacts before soldering, removing corrosion, dressing commutators, etc. Every projection room. (Warning: beware of *emery* paper. The abrasive powder it leaves behind is a *conductor*.)

SCREWDRIVERS. Several sizes, especially long thin ones, with blade no broader than the diameter of the shaft, for getting into difficult places. All should have well-insulated handles. More projectionists will prefer to magnetize their smaller screwdrivers for convenience in handling small iron bolts. Every projection room.

SOCKET WRENCHES, OR SPINTIGHTS. Several sizes. The combination tool, a screwdriver-like handle and a number of replaceable heads, is economical and convenient for all the smaller sizes. Some sound "attachments" or projector and sound bases require socket wrenches of special size, which must be obtained from their manufacturer. For every projection room, except that the special wrenches may be part of the equipment of the visiting service projectionist.

SOLDER. Rosin core only. Acid flux should never be used in sound work. It may cause corrosion which in turn will cause noise in the system that is very difficult to find. Every projection room.

SOLDERING COPPER, OR "IRON". At least one electrically-heated soldering iron is necessary, but better work can be done with two. A relatively small one is needed to get into close places without charing or unsoldering adjoining wires. A rather heavy one is sometimes necessary to impart sufficient heat for a really good job to the larger contact studs, such as those of some power transformers. Necessary in every projection room.

SOLDERING TORCH. The internal plates of a transformer or condenser absorb heat readily, and the contact stud of such a part may refuse to become hot enough for soldering when a copper is applied. Prolonged application of the iron may result in internal damage. The only remedy is the brief application of an intense heat, for which purpose a small alcohol torch capable of creating a fine-pointed flame should be available. Every projection room.

TWEEZERS. For holding wires in very crowded places, holding lens tissue, and miscellaneous use. Long tweezers with curved tips are particularly handy. Every projection room.

In addition to the foregoing, special tools for straightening spring contact prongs and other special work required by the system in question.

Blue Prints and Drawings

Trouble can *not* be found, except by luck, unless the circuits involved are thoroughly known. If drawings of every circuit in the projection room are not available, trouble-shooting may have to wait for the projectionist to trace out wires in detail and make a drawing of the apparatus or circuits in which the fault exists. Providing all necessary drawings in advance is more important than providing test meters or screwdrivers.

The manufacturer should be asked for the internal drawings and external connections of all sound parts. If these cannot be obtained, the projectionist should make them in advance of trouble. When they are obtained, the projection room conditions, especially external connections, should be checked to make sure they follow the manufacturer's standard; and if they do not, the drawings should be modified accordingly.

Record Forms

The man who is responsible for the performance of tubes, for example, is obviously entitled to a voice in the choice of tubes that are supplied. Moreover, the theatre that pays for the servicing of its equipment obviously is entitled, as part of the service it is buying, to accurate and valuable advice leading to economical and reliable purchasing of parts.

I. A. General Office Now in Washington, D. C.

Washington, D. C., is the new home of the General Office of the I. A., removal from New York, headquarters of the I. A. since its inception, having been effected on March 25. The new address is:

Earle Theatre Building
928 New Jersey Avenue, N.W.
Washington, D. C.
Phone: Metropolitan 1172

All I. A. units have been notified of the change of address.

The entire office personnel, equipment and records have been moved to Washington, with a lone worker in charge of a small office at 1450 Broadway, N. Y., the phone number of which is now: Penn. 6-0945. James Walsh, General Office worker for years, has resigned to accept a court post in N. Y. City.

MORE BUNK CONCERNING 1935 STATUS OF TELEVISION

James J. Finn

PRIZE bogeyman of the amusement world at the moment is television, the topic of more published hooey than are the antics of a Congressional investigation committee. The latest manifestation of this publishing lunacy was the appearance in a recent issue[1] of *Real America* of two articles on television the nature of which precipitated another near-convulsion on the part of workers in show business, according to the number of comments thereon reaching this publication.

Incidentally, I. P. is fast gaining recognition as a television dream-buster through its factual articles and its periodic slaughtering of distressed television publicity men and stock promoters, who amuse themselves with idiotic prophecies anent the extinction of the picture business (next week or next month) by the overnight development of this as yet baby electronic art.

But we digress. *Real America* presents on flanking pages the hallucinations of two writers whose articles on television could not possibly be more contradictory of each other. One of these writers, the editor of *Television Times*, essays a more or less rational approach to his topic and, while tooting blatantly the horn of television progress to date, proceeds to enumerate some of the well-known developmental difficulties. He winds up with the lament that television, by reason of at present unsurmountable financial and technical problems, must be "several years delayed."

Television in 1935

No longer is television "just around the corner," he states, but rather does it now lie "straight ahead", One wonders at what sort of irrigation was resorted to thus straighten out the colon of the television anatomy, what means were utilized to make an honest woman of the art. Of course, the phrase "straight ahead", like Hoover prosperity, is sufficiently vague to leave the writer on the safe side of things, and a vast improvement is his choice of prophetic language.

Flanking the aforementioned article is a delectable contribution by one Tom Harris, whose word-picture of television glories prompted the use of a caption describing him as an "amusement expert," said appelation being conferred without so much as a by-your-leave from such experts on amusement as Don Juan Boccacio and the immortal Cellini—not to mention Huey Long.

Mr. Harris gets off to a miserable start by way of justifying the aforementioned caption by predicting unqualifiedly that television "will be given a grand entrance into our lives before 1935 has much of a chance to grow old." Of course, he had stated previously that this curtsy in the grand manner had been withheld until now because of "bad money conditions generally." One wonders what this expert thinks of money conditions in March, 1935?

This "expert" ducks the necessity for any technical data by stating that laymen are ignorant of such things as "frequencies," although he is most positive in assuring us that "those little frequencies are your friends"—the darlings! From this point on he laboriously developes his theme that existing telephone wires (A. T. & T. is granted copious mention) will be used to transmit television programs.

The author's qualifications as an "amusement expert" are a deep secret to us; but we feel relatively safe in stringing along with Dr. A. N. Goldsmith, an undisputed authority on television, who in these columns last month stated:

> "Additional and formidable problems loom up when some attempt is made to discover how television programs are to be carried simultaneously to the entire country, as is necessary for reasons of general appeal and for economic reasons as well.
>
> "As it happens, the existing wire telephone lines are *not capable* of carrying television pictures. There would be required either an *entirely new, elaborate and expensive wire system* for the . . . network, or else some sort of a radio-network system with a multitude of relaying stations . . . to carry the program . . . across the country."

So much for the Harris estimation of existing telephone lines as television image carriers.

Incidentally, Dr. Goldsmith's contribution last month was intended as an article on television to end articles on television, at least for some months to come. Yet, innumerable projectionists, who have been exposed to more factual television data than any other group in the industry, were shocked into deluging the present writer with panicky letters imploring that he say it isn't so—and also that he say why.

We're saying it.

Some 'Amusement' Statistics

Other angles of the Harris contribution to the world's store of old jokes (such as Barrows of Boston is always telling) have to do with the amusement possibilities of television. Says he: "In the hands of the picture people it (television) would be worth hundreds of millions and would probably bolster up a fast-fading industry." But in the hands of A. T. & T., he continues, "it is enough . . . . to put greased skids under the motion picture industry . . . ."

Mr. Harris's broad cleavage between the picture business and A. T. & T. narrows down in our mind to a fine distinction which prompts the suggestion to Mr. Harris that he stop the next director of either Paramount or Fox he meets on the street and ask a question: Who in hell owns the picture business today, if not A. T. & T?

Favorite Indoor Sport

One learns further from this "expert" that television, when ready within the next couple of days, will "pull 90% of our population into their own parlors" there to see every conceivable form of amusement, including baseball, football, racing and other sporting events. We are assured by this specialist in amusement trends and tendencies that at a football game, for example, every seat (to the

(*Continued on page* 30)

[1] January, 1935, Vol. 4, No. 5, pp. 28-9.

Thank You!

Editor, I.P.

Sir: INTERNATIONAL PROJECTIONIST is an excellent publication ideally suited for projectionists, well-edited and up-to-date on all matters of importance to the projection field. The value of the information it contains is attested to by the many projectionists with whom we are in constant touch.

Frankly, we are not letter-writers in the sense that we are hunting for credit lines, and we read your publication for the worth that is in it and have said nothing in particular to you about it all this time. However, the foregoing is due to you, so here it is.

COLEMAN ELECTRIC CO.
Toronto, Canada.

STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING EQUIPMENT

Aaron Nadell

VIII. W. E. 46—Type Amplifier

FIGURE 1 is a schematic of one model of the W. E. 46-type amplifier. There are approximately ten models of this amplifier now in use, from the 46-A to the 46-J, or thereabout. All of these are essentially the same, using the same circuit arrangements and differing only in minor details.

One example of these minor differences can be seen in the upper right-hand corner of Figure 1, in the two binding posts marked "Mon." These are for output connection to the monitor speaker, but they are not wired to any source of speech power, because this particular model is not used to power the loud speakers directly, but through a power amplifier following the 43-type.

The binding posts just below the useless monitor terminals, marked "Output", connect the output transformer of this 46 to the input transformer of the 43 following it. If, however, this 46 were used to power the speakers directly, the 127-A output transformer (T-3, in the upper right corner) would be changed for a 127-D, and the monitor terminals wired to its secondary through a volume-controlling rheostat. The amplifier then would no longer be a 46-J, but a 46-something else.

Another feature of this particular 46 which is not found in some other 46 amplifiers may be seen in the power transformers, T-4 and T-5, in the lower right corner of the drawing. This feature consists of the tap connections—contacts 2, 3 and 4—to the primary of each of those transformers. Following the wires to those tap connections down and left, we see that they end at a terminal strip (lower left of the drawing) at which a flexible contact, "C" can be used to apply the line power to any one of the three of them.

This arrangement can be used to compensate for variations in the line voltage between 102.5 to 127.5 volts, thereby preventing overloading and danger to the amplifier where the line voltage is high, and securing normal operation where the line voltage is low. In other models of the 46 this feature is missing, and T-4 power transformer, instead of being a 303-F, is a 303-C, without primary taps. Similarly T-5 is not 303-E, but 303-B.

None of these changes, nor any of the others too numerous to describe in detail, which differentiate the various W.E. 46 amplifiers, make any difference in the circuit fundamentals. The projectionist who understands one of these amplifiers understands all of them. He need only make intelligent allowance for trivial variations in any particular model.

Tube Types Used

The amplifier shown in Fig. 1 uses six tubes. Near the upper left corner is V-1, indicated as V.T. 239-A. (The 264 is now favored for this socket.) The electrical characteristics of both types of tube are substantially identical, but the 264 is a later model likely to be somewhat quieter in operation. Directly to the right of V-1 we see V-2, also a 239 (or 264) type. Continuing rightward across the top of the drawing we find V-3, and, directly below it, V-4. These two tubes are 205's. A glance at the circuit shows that they are connected as push-pull amplifiers, their grids going to the secondary of T-2 and their plates to the primary of T-3.

Near the lower right corner of the drawing, just above power transformers T-4 and T-5, are two other 205 tubes. This makes six tubes in all. There are no others in the drawing. The bottom 205's, V-5 and V-6, have their grids grounded to their plates and therefore must be functioning as rectifiers. The plate of V-6 goes to the left side, and that of V-5 to the right, of the secondary of power transformer T-5. Therefore, V-5 and V-6 are operating as a full-wave rectifying circuit.

NOTE: Figure 1 of this article appears on the second page following.

The Filament Circuits

The filaments of V-5 and V-6 are heated in parallel by the right secondary of the filament power-transformer, T-4. The left secondary of that transformer heats the filaments of V-3 and V-4, the push-pull amplifiers.

Beginning at the left leg of V-1 filament we trace its circuit downward through R-1 and right to the switch key K-1, but since we do not yet know the function of that switch it proves faster to trace the circuit around the other way; therefore, returning through the filament of V-1 we see that it is wired in series with the filament of V-2.

Running downward from the right leg of V-2 filament we pass through rheostat R-21, obviously the filament current control. The sliding contact of this rheostat operates to short-circuit any desired portion of the resistance, but the wiring is such that this line can never open completely should the slider make poor contact. From the lower end of this rheostat the circuit continues downward to the upper blade of switch D-2, and left from the blade of that switch to a terminal post marked 12v. positive.

Obviously, therefore, the filaments of V-1 and V-2 are heated in series by an external 12-volt d.c. supply. Immediately above the 12v. positive terminal is one marked "—12v." The line from this may be traced through more than one branch, but we shall find that the circuit we want runs right. up, right through the milliammeter M-3, right, up to the right outside prong of K-1, thence to the next prong to the left, and thence left and upward to the lower end of R-1.

We now want to go into that row of terminals at the lower left of the drawing, and into the somewhat unusual wiring of switch D-2.

Power Terminals and Switches

Of this group of terminals in the lower left corner the first is marked "Gnd." and connects the iron panel of this amplifier to a water pipe or other ground. The next two are the 12-volt positive and negative connections that supply filament power to V-1 and V-2 through the circuit we have just traced. The next two are marked positive and negative "12v. Chg." When storage batteries are used for the external 12-volt supply, no separate charging switches are needed, as we can see by studying these terminals and the switch D-2.

When this switch is thrown to the right its upper blade connects the posi-

tive storage battery lead to the filaments of V-1 and V-2, as just traced; when thrown to the left, its upper blade connects the positive storage battery lead to the positive terminal of the battery charger, and opens the circuit to V-1 and V-2.

Now what does the lower blade of D-2 do? Thrown to the right, it connects the top 115-volt line terminal, through F-1 and D-1 (the door safety switch) to flexible contact C and thence to the right-hand terminals of the two power transformers. Thrown to the left, it opens the circuit to these powerful transformers at the same time that the upper blade opens the filament circuit to V-1 and V-2, and connects the 115-volt line to the battery charger.

Therefore, of the four 115-volt terminals on TS-3 (Terminal Strip 3) the upper two are wired externally to the 115-volt input of the battery charger.

When switch D-2 is thrown to the right, line power is provided to the primaries of the power transformers of this amplifier, and 12-volt power to the filaments of V-1 and V-2. When D-2 is thrown to the left all power supplies to this amplifier are cut off, line power is switched through Terminal Strip 3 to the battery charger, and the positive lead coming from the batteries is switched to the positive lead coming from the charger. The negative battery lead and charger lead are connected solid, by virtue of the jumper between the bottom "—12v." terminal and the "—12v." terminal just under the ground post.

Plate Power Circuits

The plate power transformer of Fig. 1 is T-5. The two ends of the secondary of this transformer are wired to the two plates of rectifier tubes V-5 and V-6.

The output of this rectifier, however, must have more than 1 branch, since it supplies not only the push-pull pair V-3 and V-4, but also the plates of V-1 and V-2. We shall first trace the push-pull circuit, and after that the plate lines of the smaller tubes.

From whichever end of T-5 secondary is positive at the moment through the corresponding tube to filament, and from there to the right secondary of T-4. From the mid-tap of that secondary upward through L-2, which is a filter choke, designed to remove ripple from the rectifier output. Its associated filter condensers can be seen just right of it: they are C-6 to C-11, bridged across to the negative side of the rectifier output, which is, of course, the mid-tap of T-5.

From the upper end of L-2 through L-1 and right to the mid-tap of T-3 primary. Thence to the plates of the two push-pull tubes. From the filaments of those tubes to the left secondary of T-4. From the mid-tap of that secondary up, left and up to the left side of R-18. Through R-18 and down, left, down and left to the second prong from the left of the key switch, K-1. To the outside left-hand prong of K-1 and down, right, up, right and down to the negative terminal which is the mid-tap of the secondary of T-5.

Branch Line to Plates

Somewhere along this line a branch must turn off to supply the plates of V-1 and V-2. We find the point where this line forks at the top of filter choke L-2. Instead of going upward to L-1 to supply the push-pull tubes, we turn to the left and follow left, down and left to the right side of R-17, which together with R-16 and R-15 to the left of it, constitutes a voltage divider bridged across the line.

The right side of R-17 goes to the positive leg of the line, at the top of L-2; the left side of R-15 goes to the negative as follows: downward through R-21, left through the top blade of D-2, left through the storage batteries, right through the —12v. battery terminal just under the ground terminal, continuing right, up, right and then down to the mid-tap of T-5 secondary.

A tap connection to the voltage divider R-15, R-16 and R-17 takes advantage of the voltage drop through that resistor to apply the desired voltage to the plate of V-2. This connection is made between R-16 and R-17, and the line runs up, left, up through the milliammeter M-2, which reads the plate current, and through R-10 to the plate of V-2. From the filament of V-2 the line runs down through rheostat R-21 and back to negative through the batteries, as already traced.

Now for the plate line to V-1. At the right side of R-17 this power line forks again, the branch running down, left underneath the voltage divider just examined, and up to the right-hand side of R-14, which with the resistors to the right of it, R-11, R-12 and R-13, constitutes another voltage divider. Its right side, as we have just seen, comes from the positive leg of the plate power line, but we can trace back to double-check: down from the right end of R-14, right, up to the right-hand end of R-17, right, up and right to the upper end of L-2.

The left side of this voltage divider runs to negative as follows: down, right to the second prong from the right of K-1, to the right outside prong of K-1, down, left through M-3, down, right, up, right and then down to the mid-tap of T-5 secondary.

Grid Bias Arrangements

From an appropriate point on this divider (between R-12 and R-13) a tap leads upward through M-1 and R-2 to the plate of V-1. From the filament of V-1 down through R-1, right to the second prong from the right of K-1, to the outside right prong of K-1, through M-3 and down, right, up, right and down to the mid-tap of the T-5 secondary.

Since there are no C batteries in this amplifier, grid bias must be secured through internal resistors. In the case of tubes V-1 and V-2, the filaments of which are heated with d.c., the bias resistor is likely to be found in the filament line, and we find it readily—R-1 in the left leg of the filament of V-1. The upper end of R-1 connects, of course, to the filament of V-1, and its lower end to the grid of V-1 as follows: down, left and up through T-1 primary. The lower end of R-1 also connects to the grid of V-2: down, right and up to the lower end of R-9, thence upward through the grid resistors R-3 to R-9 and right to grid through the soldered volume-control contact, which in the drawing happens to be set between R-4 and R-5.

Thus the bias of V-1 consists of half the drop through the filament of V-1, plus all the drop through R-1. The bias of V-2 consists of half the drop through the filament of V-2, all the drop across the filament of V-1, and all the drop of R-1.

Since the filaments of the other two tubes, V-3 and V-4, are heated with a.c., the bias resistor for those tubes must be in the plate circuit return. Retracing that plate circuit we find it in R-18. The left, or positive, end of R-18 connects to the mid-tap of the left-hand secondary of T-4, and thence to the filaments of V-3 and V-4. The right, or negative, side connects to the grids of those tubes through R-20 and the secondary of T-2. The bias of those tubes is, therefore, the drop through R-18.

Circuits of Switch, K-1

Before examining the speech circuits, we may as well clear up the key switch through which several of these power circuits have been traced. Apparently the amplifier will function perfectly with this switch as set in the drawing, and when it is so set the meter reads the filament current through V-1 and V-2, although the plate current finding its return through the same meter may modify the reading by about one per cent.

Now, when this switch is thrown, obviously the center prongs are pushed apart, making contact with the top arrowheads and open-circuiting the lower arrowheads. Then the filament return can no longer complete its circuit through the lower right-hand arrowhead and down through the meter. Instead (since the left central prong is wired in parallel to the lower right arrowhead) it must run through the left-central prong to the upper left arowhead, which will then be in contact with it, and so down to the left-hand side of the meter.

This switch, then, removes the meter

from the filament circuit, but does not prevent that circuit from functioning. At the same time the plate return from the push-pull tubes, which we have traced from R-18 to the lower *right* arrowhead, runs instead through the right-central prong and through the meter. This switch then, simply enables the meter to read the plate current through the push-pull tubes instead of the filament current through V-1 and V-2, whenever the central prongs are pushed apart.

The meter can be switched into either of those two circuits at will, but the other circuit is not left open; it is immediately closed by other prongs of the same switch. The adjustment of the prongs is such, in fact, that the top arrowheads close contact before the lower arrowheads open. This prevents any click being heard in the speakers when the switch is used and it does no harm, since at the moment when all four contacts are closed all that happens is that the meter is shorted, and does not read at all.

The Speech Circuits

The speech input to this amplifier is applied to the primary of T-1 speech transformer, at the upper left of the drawing. The secondary of that transformer is connected across the grid and filament of V-1: to the grid directly and to the filament through R-1.

The changes in the bias of V-1 created by this transformer-component result in the creation of a corresponding fluctuation in the plate current of that tube. The circuit of these fluctuations, which constitute the a.c. component of V-1 plate circuit, is from plate, through R-2, through C-1, through R-1 to filament.

A branch circuit runs through C-2, through volume control resistors R-3 to R-9, and from R-9 down, left and up through R-1 to filament.

The a.c. voltage drop developed across resistors R-3 to R-9 connects to the filament of V-2 through the filament of V-1, and to the grid of V-2 through the soldered connection by means of which the volume output from this amplifier can be set to a desired average level—volume control during the course of the show being controlled before the speech current reaches this amplifier. The alternating component in the plate circuit of V-2 flows through R-10 and C-3, with a branch circuit through C-4 and the primary of T-2.

Pos. and Neg. Grid Action

The outer ends of T-2 secondary connect to the grids of V-3 and V-4, the filament return being through center-tap and the bias resistor R-18 to the center-tap of the filament supply primary, the left-hand primary of T-4 power transformer. In this conventional push-pull connection the grid of V-3 must swing positive while the grid of V-4 swings negative, and *vice versa.* Hence the plate current of V-3 increases while that of V-4 decreases.

The two plates are connected to the outer ends of T-3 primary. Since the plate circuit must return to filament, we trace this return from the mid-tap of T-3 primary down through L-1, right through condensers C-6 and C-7 (which thus serve not only as plate supply filters but also as by-pass condensers for the plate a.c. component); right, down, left, down, left and up to the left outer prong of K-1; through the lower left arrowhead of K-1, down, right, up, right, up, left through R-18, down, right and down to the center-tap of the filament secondary, thence upward to filament.

The a.c. component in the primary of T-3 generates the output voltage in the secondary of that transformer which is led through the output terminals to the amplifier following.

In tracing this drawing we have endeavored to indicate how the reader can apply his own common sense to unknown and doubtful points. There are so many amplifiers now in use that tracing the circuits of all of them in detail is wholly impossible. The projectionist—and especially the projectionist who intends to undertake sound servicing—*must* learn how to trace these things for himself.

[NOTE: Any questions arising out of the foregoing discussion by Mr. Nadell will be answered by the author in a special Question and Answer department which will supplement future presentations of sound reproducing data. —*Editor.*]

CAMERON APPOINTED

James R. Cameron, noted projection authority and author of several standard works on motion picture visual and sound projection, has been appointed a member of the Projection Practice Committee of the S. M. P. E.

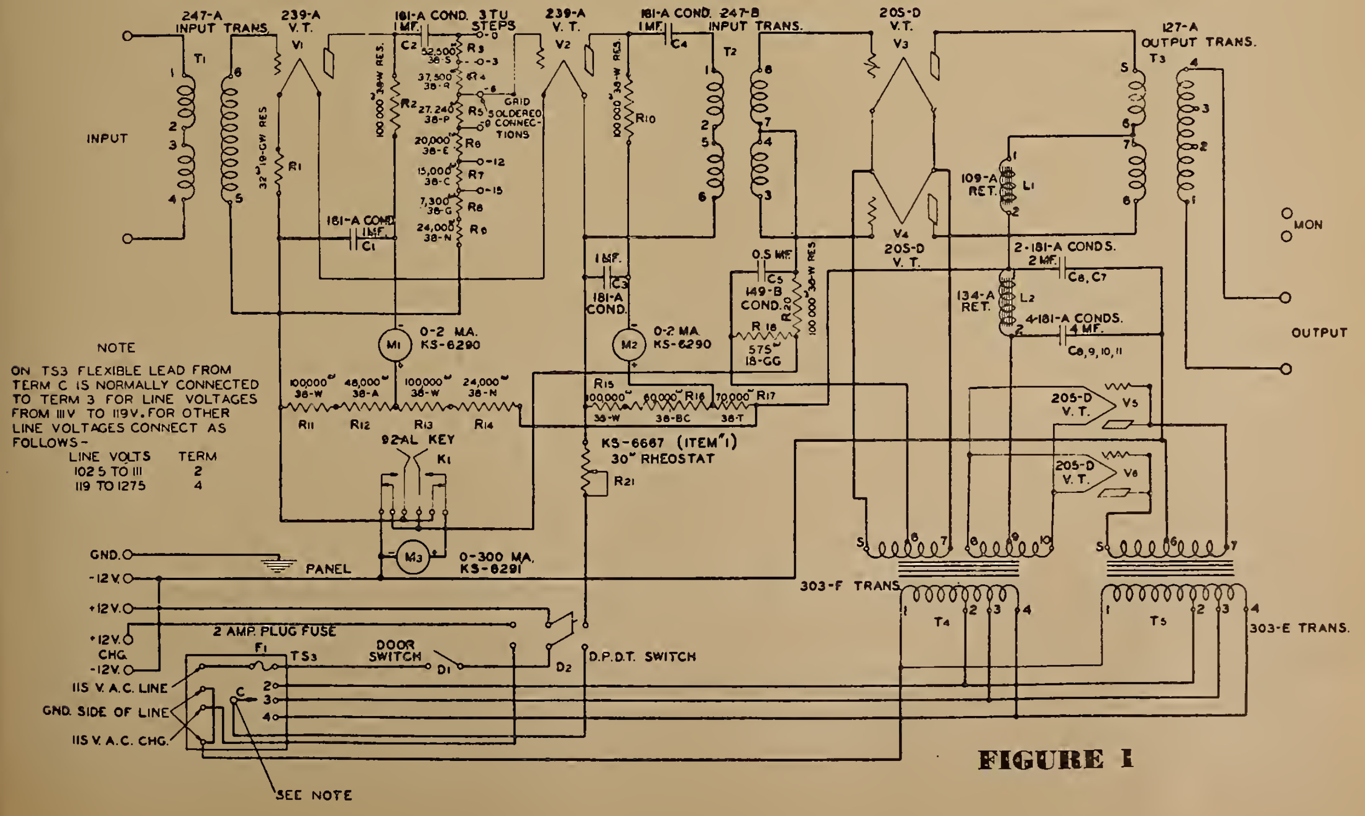

FIGURE 1

Questions and *Answers* on Sound Projection

Aaron Nadell

NOTE: This department is launched in response to numerous requests by readers for such a service. The worth of this section, which will be a monthly feature, depends wholly upon the cooperation given by readers: the more numerous the inquiries, the more varied the department and the greater its value. Correspondents are requested to be specific and as brief as possible. Only initials will be appended to questions.—EDITOR.

Q. The plates of the larger tubes sometimes become red. What causes this, and does it harm the system?

A. This is an undesirable condition and indicates that some degree of distortion is taking place. The most likely cause is high line voltage at certain hours. Check the voltage, or ask the power company to do so. If condition does not readily yield to correction, a voltage regulator is necessary. Carbon plate tubes are desirable, also.

Q. What is the reason for resistors R-2 and R-3 in the Erpi 519 panel?

A. They are bleeders to protect the filter condensers, C-1 to C-42, and the 8-B amplifier, against a rise in voltage when the 10-A amplifier is cut off.

Q. I detect a slight hum in the theatre, which sounds like 60 cycles. It's the same with both projectors, but it isn't in the speaker field circuit because it sounds the same with headphones. What is your opinion?

A. Try tightening the holding nuts of the power transformers in the amplifier. Also, make sure that the ground connection is clean and tight.

Q. Is it true that I can use an RCA 35 tube in place of a 24-A in the first stage of the sound amplifier?

A. These tubes are nearly but not quite identical. It would be O. K. to use a 35 if no 24 were available, but it is better to use the latter.

Q. Why are some exciter lamps more difficult to focus than others, although they look exactly alike?

A. The filament may sag in certain lamps when they become hot. Examine the filament while the lamp is lighted, using two thicknesses of colored gelatine.

Temporary Sound Loss

Q. I've lost sound three times within the last two months. Each time it has cut off for several seconds and then came back of itself. Our sound has also been noisy for a long time. I suspect a loose connection, but can't seem to find it.

A. If the noise is the same on both projectors, the faulty contact is in the amplifier, speaker circuits or a common supply line. Otherwise, it is in the noisy projector and its supply line.

Try leaving the power amplifier turned on and the voltage amplifier off (after show hours, of course) and listen for noise. If you hear none, the trouble is not in either speakers or power amplifier. Listen for noise in the non-sync. If not located here, check the connecting line between projector and amplifier.

After you have found the approximate location of the noise, try to make it reveal itself by tapping suspected panels and pulling at suspected wires. Pay particular attention to tubes, socket connections, rheostat and switch contacts, and soldered joints in connection with the suspected panel.

Submit Your Questions

Tri-Ergon Claims Denied by Supreme Court

William Fox was frustrated in his efforts to collect approximately twenty millions of dollars in royalties and licenses from the motion picture industry when on March 4 the U. S. Supreme Court held invalid his Tri-Ergon patents which have been the basis for prolonged and expensive lawsuits, and not a little apprehension, since 1933.

Two suits were decided: one against Wilmer & Vincent on the so-called flywheel patent, and the other against Paramount on a method of printing simultaneously on one negative both the picture and the sound track.

Reversing decisions of lower courts in both cases, the Supreme Court held that "examination of the prior art can leave no doubt that the methods . . . lack novelty and invention." The decisions would appear to end all American litigation based on the Tri-Ergon sound picture patents.

EARLY & ADEQUATE TREATMENT—A MODERN WEAPON TO FIGHT TUBERCULOSIS

F. M. Pottenger, M. D.

An Early Diagnosis Campaign is now being conducted throughout the United States by the affiliated tuberculosis associations. Under the slogan, "Fight Tuberculosis with Modern Weapons," they are offering the public information on modern methods for treating the disease. This article is a release of the National Tuberculosis Association. I. P. endorses this work, which has helped so many projectionists, and solicits every possible aid for the national campaign now under way.—Editor.

THE annual Early Diagnosis Campaign, sponsored by the National Tuberculosis Association, has as its purpose the detecting of tuberculosis in its beginning when the lesion is small and capable of being brought within control relatively easily. This year the Association is stressing not only early diagnosis but also early treatment. Let the stress be not only on early treatment, but on immediate treatment, and furthermore on adequate treatment.

When a diagnosis of tuberculosis has been made, there are certain objectives to be arrived at at once: first, that the disease process does not break down, or if this has already occurred, that the loss of tissue be as slight as possible, and second, that the disease spreads to no new tissues, or, if this cannot be prevented, that such spread be limited as much as possible.

These two objectives are attained with

(*Continued on page* 28)

The X-ray is indispensable in the modern diagnosis of tuberculosis. Its powerful eye penetrates the lung and reveals the early damage done by the elusive tubercle bacillus.

COPPER-OXIDE RECTIFIERS FOR PROJECTION ARC SUPPLY

BY A STAFF WRITER OF INTERNATIONAL PROJECTIONIST

COPPER-OXIDE rectifiers are by no means new. While applied only recently to visual projection work, as a source of power supply for the arc, this type rectifier has been used for several years as a battery eliminator in theatre sound systems. Its efficiency and economy in this work, as well as in a varied assortment of other industrial applications, naturally led to the development of a unit suitable for projection work.

As is the case with any new development, the copper-oxide rectifier has been the target for not a little criticism, most of it vague and couched in very general terms. For example, doubt has been expressed in certain quarters relative to the life of the rectifying elements.

Tests conducted under actual service conditions for more than eight years, and still in progress, fail to show any limitation on the life of these elements. "Unlimited life" as applied to these elements may be taken to mean just that.

There is nothing mysterious about the application of this type rectifier to projection work, as will be apparent from the following brief explanation.

Rectifier Components

The rectifier consists of a sheet, or disk, of copper having a layer of cuprous oxide thereon, as is shown in Figure 1. Rectification takes place between the oxide and the mother copper. The valve operates electronically, and *not electrolytically*, hence it does not decompose, regardless of the length of service. Simply expressed, this rectifier has nothing that is "used up," as does the bulb-type rectifier.

The manufacturing process for the c.-o. rectifier is of interest. The flat copper disk is subjected to a high temperature which forms a coat of red, or cuprous oxide, on one side thereof. This piece of oxidized metal has the property of passing current freely in the direction of oxide to copper, while at the same time having a high resistance to current flow in the *opposite direction.* For example, approximately 9000 times as much current can be passed in one direction as in the other, with the same applied potential.

Since the copper-oxide rectifier has a negative temperature coefficient of resistance in both directions, an increase in temperature will tend to lower the resistance in both the so-called backward and forward directions. This is of importance only as regards the high-resistance direction through the rectifier.

To prevent too great an increase in what shall be termed back current, means must be provided for radiating the heat and keeping the rectifier ventilated. This is accomplished, first, by providing the rectifier with sufficient cooling fins to dissipate the heat in a particular unit.

Group Disks and Fins

Naturally there is a limit to the amount of heat that can be dissipated by this means: current requirements may be greater than can be dissipated from the disk by the cooling fin, thus enough additional disks must be connected in multiple to obtain the desired current.

For instance, let us assume that one disk and one fin will dissipate the heat generated when the rectifier is passing one ampere of current. Then with two disks and two fins connected in multiple a current of two amperes can be passed and still keep the heat within safe limits. Thus it becomes a problem of grouping sufficient disks and fins in multiple to adequately pass the desired number of amperes.

The next consideration is voltage, there also being a limit to the voltage that a single disk can withstand. Therefore, a sufficient number of disks must be connected in series to withstand the voltage that the rectifier is required to pass.

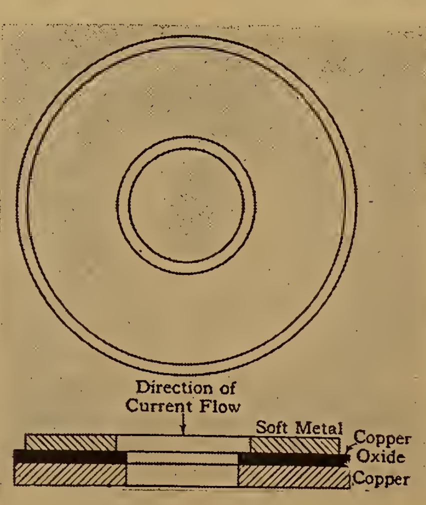

FIGURE 1

In building up a unit from individual disks, contact with the oxide surface is important in order to reduce the resistance as much as possible. A common method of doing this is known as graphitizing. Additional improvement results from the use of a soft-metal contact disk, which is forced by pressure into intimate contact with the graphitizing surface.

Current is increased in the useful direction with increased pressure at a constant voltage. As might be expected, the resistance decreases uniformly with increasing pressure until complete contact is obtained, after which no further change occurs, which point is reached at a pressure of about 3,000 pounds.

The disks will operate in either series or parallel, thus the construction of a complete unit for any desired rating is simply a problem of assembling the proper number of disks into a unit.

Obtaining maximum efficiency from a copper-oxide rectifier depends upon working the elements at proper current, voltage and temperature. Properly designed, this type of rectifier will demonstrate an overall efficiency of 70 per cent, which figure compares favorably with that of the bulb-type rectifier and is considerably higher than other means now employed for converting A. C. to D. C. for the projection arc.

No practical definite rating as to the capacity of a copper-oxide rectifier because the governing factor is temperature. Thus, the capacity of a given size element will depend on the ambient temperature, the method of ventilation employed, and the amount of radiation. As long as the unit can be kept cool (by which is meant below 50° C.), there is no limit to the amount of current that can be passed through it.

Consideration must be given to the fact that the unit ages—that is, as it gets older its resistance increases and, therefore, the heat to be dissipated increases. Hence, the unit must be so de-

(*Continued on page* 27)

The Answer to the Que

A. C. OR D. C. SUPRE

THE ANSWER
by *James J. Finn*

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First, the term "Suprex" does not necessarily mean only the D. C. arc, as is implied. The word Suprex refers to a particular type of carbon and arc. In fact, Suprex carbons were originally intended for burning on A. C.

To state that the "useful light" from the A. C. arc is produced by the gas ball is to cite the effect and ignore the cause, because without the crater there would be no gas ball. Thus, the terms "gas ball" and "crater" are synonymous for purposes of this discussion. The gas ball is wholly dependent upon what occurs within the crater area, which, in turn, is dependent upon the conditions set up when A. C. is supplied thereto.

The analogy between the A. C. arc and an incandescent lamp has no direct bearing on the question in hand: a tungsten filament, once heated, stays hot during the time the current supply falls through zero; but an A. C. carbon arc does not behave similarly. It is true that the new A. C. carbons have a longer carboration period than do other carbons (due to the earth metals composing the core), but this time interval does not compare favorably with that of an incandescent lamp filament.

Effect of Shutter Action

What *does* happen in an A. C. arc at the moment of zero voltage? The carbon company and the lamp manufacturers admit that the drop is something more than 20 per cent; while other reliable estimates place the figure at 30 per cent. Let us assume the drop to be 25 per cent.

Up to this point one can string along with Mr. Hoffman. But right here all this talk of gas ball and crater and carboration period becomes—just so much talk. Our correspondent's questions suggest another, and vastly more important, question:

What about the shutter?

One recalls with amusement how the A. C. arc was first demonstrated without a shutter. But, unfortunately for A. C. arc adherents, a shutter still is necessary for motion picture projection. Not even in Mr. Hoffman's worthy contribution to the art does one note any suggestion for equalizing the difference in frequency between 60-cycle A. C. and that of the shutter. Nor is there available any type of shutter that will solve this problem.

Mr. Hoffman is correct in stating that this writer witnessed a demonstration of the Hoffman & Soons arc control and that it met wit hhis approval. We still think it is great—*as an arc control.* It serves perfectly to maintain the arc gap constant and thus to prevent slow changes of light intensity and color. But neither this nor any other arc control has anything to do with the flicker in an A. C. carbon arc, as previously explained.

The term "harsh" was applied to the A. C. arc by Mr. Joseph E. Bliven in an article[1] in these columns, and undoubtedly reflects that writer's opinion of the screen effect produced by the A. C. flicker.

When Mr. Hoffman enters upon a discussion of light intensity and operating economy it is akin to walking unarmed into the camp of a mortal enemy. Acceptance of his comparison in terms of re-

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The Question: Why Not L. I. Lam

Ernest Hoffman
HOFFMAN & SOONS ELEC. ENG. CORP.

YOUR article in INTERNATIONAL PROJECTIONIST for November, 1934, which condemned the A. C. arc, and the report of the Projection Practice Committee of the S. M. P. E. on the same topic, fail to win the approval of this writer.

You and all the other critics of this light source (A. C. arc) will grant, I think, that the light therefrom being the product of the gas ball produced by the high-intensity A. C. carbons, there can be no flicker visible to any greater extent than is experienced with an incandescent lamp—assuming, of course, that the arc is properly maintained so as to prevent any distortion of the gas ball.

This can be done by a proper arc controller designed specifically for this purpose. Having demonstrated our arc controller to you in October, 1934, we assumed that it met with your approval and that you were in accord with our views in this matter. It was a matter for considerable surprise on our part, therefore, when we subsequently read your attack on the A. C. arc, no less than when we read the S. M. P. E. Projection Committee report on the same topic.

Comparison of Operating Costs

You speak of "harshness" in the A. C. light on the screen. This we will grant you in a case where this light is projected on a beaded or other type of reflective screen which is unsuitable for this particular type of light source. Incidentally, there will be visible "harshness" when this type of screen is used with the much-heralded Suprex D. C. arc which you so unreservedly recommend.

Your endorsement of this latter type arc is particularly difficult to understand in view of the great economies possible with the A. C. arc. The A. C

tion:

ARC OPERATION?

sults and costs as between low-intensity and the Suprex A. C. arc, effectively blocks off any reasonable answer to a similar comparison drawn between the latter and the D. C. Suprex arc. Let's dig into this.

A. C. vs. D. C. Suprex

The difference in light intensity between the L. I. and the Suprex A. C. arc may not be 300 per cent, as Mr. Hoffman states, but it is sufficiently large in itself to eliminate the L. I. arc from the running. On the basis of *quality* of light (the Suprex white light against the L. I. dirty yellow), there is no comparison.

But Mr. Hoffman obviously is not concerned with the question of L. I. against the Suprex A. C. arc but rather with the latter arc vs. the Suprex D. C.—with his whole argument turning on replacement and subsequent operating costs. Well, let's see.

Consider carefully the following statement: The D. C. Suprex arc at 45 amperes gives *twice the light of the A. C. arc at 80 amperes!* Now, Mr. Hoffman asserts that it is cheaper to operate Suprex carbons on A. C. than on D. C. This is just not so; and we shall be glad to receive from Mr. Hoffman any figures which bear out his statement. The advantage, if any, rests with the D. C. arc as has been proven conclusively by tables of operating costs published in these columns.

For the same operating costs, then, the D. C. arc gives twice the light obtainable from an A. C. arc, using the same carbon trim—*and without flicker!*

In passing, we might observe that any theatre desiring to obtain Suprex results may use the 5 and 6 mm. trim and operate at 30 amperes without overloading its present generator, as cited by Mr. Hoffman. National Carbon Co. recommends this amperage for this trim, which is as economical to operate as the L. I. arc.

Up to this point it has been established that Suprex is far superior to L. I. operation; that Suprex operation costs but two cents per hour more (if that much) than L. I. arc operation, and that as between the A. C. and the D. C. Suprex arcs, the latter not only far outclasses the A. C. arc in quality and quantity of light but also is as economical to operate. Of course, on the basis of *lumens per dollar* this discussion would be futile, if not actually ridiculous.

Thus, there is left only one major contention made by Mr. Hoffman: the advisability of our recommending the replacement of present equipment by new Suprex D. C. lamps and the necessary powering devices. Our correspondent clearly favors the conversion of existing equipment for A. C. Suprex operation. Although A. C. is out of the question as far as this writer is concerned, he is quite willing to discuss the question of converting present equipment.

After Conversion—What?

To the best of our information and belief, the cost of converting existing lamp equipment will approximate $125 for each lamp, or a total room cost of at least $250. The question to be posed here by the alert exhibitor and projectionist is not how much a conversion job will cost but rather what will they have after the conversion job is finished.

The unequivocal answer of this writer to this question is that a lamp conversion job will leave Mr. Exhibitor and Mr. Projectionist with a projection room full of junk!

Mr. Hoffman states that any existing mirror arc can be used for an A. C. Suprex arc. Now, this writer doesn't know the standards on which Mr. Hoffman bases this assertion, but he does know that judged by any reasonable standards of projection work this statement is emphatically not so. Considering optics and adequate ventilation as more or less important factors in lamp design, a converted lamp job is wholly unsatis-

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Conversion for Suprex Operation?

arc consumes 2200 watts from the line, and there is an increase of approximately 300 per cent in light over the present low-intensity lamp at 30 amperes, which consumes 5 k.w. from the line.

Carbon costs alone for the Suprex D. C. arc (National Carbon Co.'s own figures), are 21.4 cents per hour, as compared with a cost of 5 cents per hour with the low-intensity trim. In addition, there is approximately a 50 per cent increase in power consumption where present motor generators are used in an overloaded condition, which means decreasing generator life and upping the line consumption from 7 to 9 k.w., depending upon the efficiency of the m.g. set.

All of this reflects very unfavorably upon your advocacy of scrapping present equipment, plus increasing the cost of operation, at a time when almost all theatre owners are wondering how to make ends meet.

Your advocacy of rectifiers also seems to us to be unjustified from an operating standpoint. Although you are correct in citing an increase in operating efficiency when rectifiers are used, this advantage is more than offset by the cost of rectifier bulbs, which have to be replaced from time to time. As you know, these bulbs are guaranteed for 1,000 hours. The average theatre operates approximately 3,650 hours yearly, which means that there will be at least two or three changes of bulbs per year—at considerable cost.

Any type of mirror arc in use at the present time can be used for an A. C. arc, provided there is made available a proper transformer and an arc controller that will do the work. The arc controller is the crux of the problem of how to satisfactorily operate an A. C. arc.

Had the lamp manufacturers developed an efficient arc control, the Suprex D. C. arc would never have been heard of. As far as we personally are concerned, and on the basis of the foregoing statements, we still have faith in the A. C. arc and we are going ahead with the work, now nearly complete, of making available a proper arc controller.

The Answer to the Question: A. C. OR D. C. SUPREX ARC OPERATION?

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Carbon costs alone for the Suprex D. C. arc (National Carbon Co.'s own figures), are 21.4 cents per hour, as compared with a cost of 5 cents per hour with the low-intensity trim. In addition, there is approximately a 50 per cent increase in power consumption where present motor generators are used in an overloaded condition, which means decreasing generator life and upping the line consumption from 7 to 9 k.w., depending upon the efficiency of the m.g. set.

All of this reflects very unfavorably upon your advocacy of scrapping present equipment, plus increasing the cost of operation, at a time when almost all theatre owners are wondering how to make ends meet.

Your advocacy of rectifiers also seems to us to be unjustified from an operating standpoint. Although you are correct in citing an increase in operating efficiency when rectifiers are used, this advantage is more than offset by the cost of rectifier bulbs, which have to be replaced from time to time. As you know, these bulbs are guaranteed for 1,000 hours. The average theatre operates approximately 3,650 hours yearly, which means that there will be at least two or three changes of bulbs per year—at considerable cost.

Any type of mirror arc in use at the present time can be used for an A. C. arc, provided there is made available a proper transformer and an arc controller that will do the work. The arc controller is the crux of the problem of how to satisfactorily operate an A. C. arc.

Had the lamp manufacturers developed an efficient arc control, the Suprex D. C. arc would never have been heard of. As far as we personally are concerned, and on the basis of the foregoing statements, we still have faith in the A. C. arc and we are going ahead with the work, now nearly complete, of making available a proper arc controller.

factory. That a lamp conversion job is possible we freely admit; and we admit just as freely that if this idea is to prevail we might just as well throw all standards of projection quality out the window.

We wonder if Mr. Hoffman and many others in this field really know how, why and where the lamp conversion idea originated in connection with Suprex carbons. The story is simple but very interesting. When Suprex carbons were introduced practically nobody considered burning them on other than A. C. That was definite, final and conclusive.

Hundreds of thousands of dollars were expended on design, tools, labor and advertising in behalf of the A. C. arc. The campaign swept across the country and enmeshed many an unwary lamp manufacturer, exhibitor and projectionist before anybody awakened to the fact that the arc was something less than satisfactory.

The Conversion Process

About the time the A. C. arc started to grip the popular fancy, Harry Rubin, of Paramount-Publix, became interested in Suprex carbons. Drawing on his long experience, he saw almost immediately that the A. C. arc just wouldn't do. But what was to be done about it, with the A. C. arc taking everybody by storm?

Rubin did the logical and, of him, the expected thing. In an effort to stem the tide of the A. C. arc he went to work feverishly and, conceiving the idea of altering existing low-intensity equipment for Suprex carbons, proceeded to burn the carbons on D. C. Not one but several such installations did he make and nurse along carefully every day over a period of months.

Finally convinced that he was correct, Rubin broadcast his findings to every part of the country. He took on all comers—the lamp manufacturers, the carbon people, engineers, projectionists, exhibitors and what have you. It is merely coincidental that about this time the first stream of complaints on the A. C. arc started to trickle in—a stream that finally swelled to a torrent and sent manufacturers and supply dealers scurrying for cover, to their mental and financial discomfiture.

That the A. C. arc ultimately would have been thoroughly discredited is as certain as death, yet it will do no harm to credit Harry Rubin with a magnificent job and one that saved the industry hundreds of thousands of dollars.

General Opinion Today

Rubin didn't believe wholeheartedly in a conversion job. He turned to that as a last desperate resort in order to prove his contentions. Today he holds that, with the A. C. relegated to the projection storehouse, there is no more justification for a converted lamp job than there was for the A. C. arc.

Today there isn't a lamp manufacturer, except one, who will defend the A. C. arc. Messrs. Ashcraft, Brenkert, McAuley and others state frankly that the A. C. arc is not to be compared with the D. C. arc, granting the existence and recognition of some semblance of projection standards.

If these manufacturers, after years of designing, building, installing and servicing arc lamps, don't know something about them, pray, who does?

Mr. Harry Strong is the lone manufacturer to still profess his faith in the A. C. arc. He constantly asserts his ability to prove beyond any reasonable doubt that the opinion of this arc held by practically the entire projection field—lamp manufacturers included—is wholly erroneous. Yet, an invitation from this publication to come forward and expose this proof to the light at its expense has

A MANUFACTURER'S VIEWS ON L. I. LAMP CONVERSION

Karl Brenkert

BRENKERT LIGHT PROJECTION COMPANY

International Projectionist invited all arc lamp manufacturers to submit their views on the desirability, or lack of it, of converting existing low-intensity arc lamps for Suprex carbon operation. We present herewith the opinion of the first to respond to our invitation—Mr. Karl Brenkert, one of the leading arc lamp manufacturers.

Appended to Mr. Brenkert's contribution was the following significant comment: "Not included in my statement is mention of the not insignificant expense of a conversion job . . . In common with every manufacturer who values highly his trade-mark, I feel that a free and open discussion of such topics will benefit both manufacturer and customer. I felt similarly about the A. C. arc and regretted the absence of an exchange of views between maker and user. You are to be congratulated for sponsoring such discussions."—*Editor.*

1. Air Draft Conditions

The Suprex carbon arc is very sensitive to air drafts. Low intensity lamphouses are not ventilated properly for operation of this arc.

2. Magnetic Arc Balance

The Suprex carbon arc is very sensitive to stray magnetic flux, which is very pronounced in low-intensity lamps but is not in a properly constructed Suprex carbon arc lamp.

3. Variable Motor Speed

It is necessary that the Suprex carbon feed, when once adjusted, be maintained constant. The arc control of low-intensity lamps, therefore, cannot be used and the motor should not be used as it is not of the constant-speed type.

4. Adjustable Feed Screws

The low-intensity arc burns carbons wherein the positive and the negative carbon maintain a set ratio of consumption for all arc currents. With the Suprex arc, however, the negative carbon consumption is practically constant for all arc currents, and the positive carbon consumption increases rapidly as the current is increased. The feed screws of the Suprex lamp for proper operation should be adjustable; whereas in a low-intensity lamp they are not.

5. Striking The Arc

The Suprex carbon arc should be struck with rapid action to prevent flame flare-back and a damaged positive carbon. Low-intensity arcs do not have any means for rapidly striking the arc. Suprex carbon arcs are invariably operated at higher arc current than low-intensity lamps and, therefore, carbon jaws and all current carrying parts must be of heavier construction than on low-intensity lamps.

6. Mirror Protection

The Suprex carbon arc, being of the flaming arc type, must have a means of protecting the mirror while the arc is being struck. This is ordinarily called a mirror flame shield. Low-intensity arcs do not require this and therefore, are not equipped with same.

7. Magnetic Stabilization

The Suprex carbon arc, for stable operation and constant screen illumination, requires properly balanced magnetic influence on the arc, which must be introduced in proper relation to the arc and in proper amount. Low-intensity lamps are not so equipped.

been ignored by Mr. Strong for almost a year now.

So much for the A. C. arc.

Mr. Hoffman makes some interesting statements about our advocacy of rectifiers. While admitting rectifier operating efficiency, he cites the 1000-hour guarantee on rectifier bulbs and mentions the need for replacement "two or three times per year." With this view we can not agree.

Status of Rectifiers

The fact that a given article, rectifier bulb or otherwise, bears a *minimum life* guarantee is no indication that its life is thus definitely limited. This writer's experience is that a large majority of rectifier bulbs operate efficiently for more than 3000 hours, which fact would seem to vitiate Mr. Hoffman's argument by at least two-thirds. Further, rectifier current savings pay for a set of bulbs in approximately 450 to 500 hours operation. But, we have a question to ask in turn:

What about the cooper-oxide rectifier, requiring no bulbs, that is equally as efficient as the bulb-type rectifier?

S. M. P. E. Projection Report

Those worthies on the Projection Practice Committee of the S. M. P. E. need no special defense herein for their advocacy of the Suprex D. C. arc, having demonstrated on numerous occasions the ability to more than take care of themselves. Still, it is significant that the Committee report that considered the Suprex arc was delivered before the largest attendance of any Society convention session and not one of the many noted technicians and manufacturers present challenged its findings.

Subsequently the Committee report was broadcast throughout the industry, and to this day not a single objection to its content has been received.

Mr. Hoffman at the close of his letter reiterates his faith in the A. C. arc and insists that a "proper arc controller" will solve the problem. In turn, this writer reiterates his lack of faith in the A. C. arc and insists that an arc controller, proper or otherwise, has nothing to do with the shortcomings of the A. C. arc.

As for the particular controller that Mr. Hoffman has in mind, we repeat that we think it a very fine arc control and express the wish that it will be a great success.

Academy Sponsors Projection Educational Campaign

The Academy of M. P. Arts & Sciences has named a group of studio sound engineers to work out some effective plan to place accurate technical data at the disposal of projectionists regarding particular sound reproduction problems, and to interest the projectionists in the Research Council's effort to obtain better technical product on the theatre screen.

It was pointed out that such an educational campaign is particularly appropriate at this time due to the increasing interest in improved sound recording and reproduction on the part of the producing companies, and that such a campaign will help to give the companies a maximum benefit for money expended on sound recording.

The Subcommittee has been appointed only to consider the various suggested plans for such a campaign, and it was announuced that if a practical working plan is recommended and adopted by the Research Council, the Subcommittee to be appointed to ultimately carry on with the project will contain representation from the studio, distribution, exhibition and projection ends of the industry.

NEW EASTMAN DIRECTORS

Herman C. Sievers, vice-president of Eastman Kodak Company in charge of sales and advertising, and Perley S. Wilcox, president of the Tennessee Eastman Corporation have been elected to the Kodak board of directors, filling vacancies caused by the death of Lewis B. Jones and of Rudolph Speth.

Marion B. Folsom at the same meeting was chosen as treasurer, an office made vacant by the death of Mr. Speth, Feb. 22; and Cornelius J. Van Niel was elected to the newly-created office of general comptroller.

SOME PROBLEMS OF MOTION PICTURE ENGINEERING

Dr. A. N. Goldsmith

Herein are discussed the functions of the engineer and the artist, as well as certain aspects of parts engineering, including improvement of the film, the camera, lenses, studio lighting, recording and laboratory processes, and theatre reproduction. This paper, originally presented before the S. M. P. E., urges an open mind and a determined attempt by all workers favoring continuous evolution of the art.— Editor.

THE problems of any branch of engineering depend upon the aims of that branch. While it would be most difficult, if not impossible, briefly to define the aims of mechanical or electrical engineering, for example, it is fortunate that a reasonably acceptable definition can be contrived for motion picture engineering. It is the presentation of a real or imagined happening to the audience in such approach to perfection that a satisfactory illusion of actual presence at the corresponding event is created. Briefly, it is the production of an acceptable semblance of reality.

In considering the problems of motion picture engineering, there must not be assumed any implied criticism of the fine work which has been done in the past. The results already available are a convincing testimonial for what has been done by the technicians. Yet the motion picture industry can not stop at that point. No industry that hopes to retain public patronage on so vast a scale can afford to be smug and self-satisfied. We have not yet reached our goal—and perhaps we never shall.

Two Broad Divisions

Motion picture engineering falls into two broad divisions—system engineering and parts engineering. Historically the latter generally comes first. Individual parts of the complicated series of devices necessary for the final presentations to the public are invented; are built in crude form; are tested and found wanting in some respects; and are improved in a series of steps toward an acceptable performance.

But parts engineering is not enough. By coordinating each device with the others, and by fully appreciating the way in which each part fits into the entire structure, greater effectiveness of operation, superior results and marked economies generally result.

We may safely assume that every device now used by motion picture engineers can be improved, that new devices for functions not yet filled can be contrived, and that the relation of each part of the system to the whole system of audio-visual recording and reproduction requires study and consequent technical development.

Film—The Raw Material

In the brief presentation which is the subject matter of this paper, only parts engineering can be conveniently considered. Even so, the subject is so vast that only a brief and partial summary can be given. It is obvious that present and possible future problems can be listed but that their solutions can not be given—to do so would be to overleap human mental and time limitations.

Considering first the raw material and

(*Continued on page 24*)

PROJECTIONISTS SCORE WIDE SERVICE WORK GAINS

NO UNTOWARD happening marked the progress of projectionist organizations during the past month in their efforts to supplant the electrics in the job of servicing theatre sound systems and visual projection equipment.

From sources close to the electrics came the report that "a deal" relating to servicing work had been made by the electrics with the International Alliance; but INTERNATIONAL PROJECTIONIST is officially authorized to say that there is no truth in such reports.

Another report concerned the possibility of the electrics refusing to sell projectionist organizations needed replacement parts and accessory equipment, should projectionists succeed in obtaining service contracts. The attitude of projection men to this rumor is that several independent sources of supply could be tapped for all necessary parts; in fact, this publication is prepared to furnish a list of such manufacturers and distributors.

Erpi continued to cloak its current activities and future plans for theatre service work in strict secrecy, no official announcement of policy being forthcoming. No change in the RCA attitude, reported in detail in previous issues of this publication, was noted.

In reply to the electrics' oft-repeated statements that their contemplated theatre servicing work would not interfere now or in the future with the activities of manufacturers, dealers and projectionists, there appears elsewhere on this page a record of bids by the electrics on both the *sale and installation* of a complete sound projection system, including two projectors, a screen and a sound system. Distribution of these bids among supply dealers and manufacturers created a furore in their ranks and caused a wave of resentment against the electrics.

More Circuits Drop Service

To the already long list of theatre organizations who have dispensed with Erpi servicing and are now doing their own work—including the Warner and Loew chains—can now be added such representative theatre circuits as Dallas Interstate, Balaban & Katz, Fox West Coast, and St. Louis Amusement Corp., to name only a few.

Fox West Coast, the largest single theatre chain in the country is now doing its own servicing work and will purchase a large portion of its replacements from independent sources. With practically all the larger chains now having dispensed with Erpi service and parts contracts, it is apparent that Erpi now has left only the smaller theatres with limited budgets which prohibit large service and parts fees.

Balaban & Katz (Chicago) and Dallas Interstate (Texas) are Paramount affiliates under the 50-50 partnership arrangement which marked the recent decentralization of this once huge theatre chain. Very significant in this respect is the following statement appearing in *Film Daily*:

> "Hearing will be held . . . on approval of the agreement between the Paramount trustees and Erpi under which Erpi's claim for $2,022,597 against Paramount is allowed as a general claim for $1,193,945. The agreement . . . permits Paramount to make new agreements with Erpi under which there will be no compulsory servicing or inspection charge on sound equipment . . ."

Thus, not only does Erpi incur a loss of one million dollars through reduction of its claim, but the Paramount theatre affiliates are released from the clutches of the electrics and can now arrange for servicing and replacement parts on their own terms. Contracts covering tubes, for one item, have already been closed with an independent manufacturer.

Considering these developments, it would appear to be an increasingly difficult task for the electrics to continue their extensive field operations and maintain their top-heavy home office clerical and executive staffs—not to mention elaborate office quarters. Erpi is particularly affected on this basis, RCA having adopted more than two years ago a very liberal policy of outright sale and no compulsory servicing.

Under such circumstances, it is pointed out, the time is ripe for a concerted drive by projectionist organizations to move right into the servicing picture. The action taken by the larger theatre circuits would seem to be the best possible sales argument in favor of discontinuance of swollen service and inspection contracts, plus parts purchase restrictions.

I. A. Attitude Unchanged

On the Union front there was considerable activity but little publicity. Evidently alarmed by the determined attitude of George E. Browne, I. A. president, who announced his unqualified opposition to any encroachment by outsiders on the jurisdiction of I. A. members, the electrics are generally understood to have sponsored the propaganda relating to "a deal" with the I. A. on servicing.

The attitude of the I. A. toward non-Union servicing, and particularly the projected extension of the electrics' influence in the projection field, has not changed a bit.

Numerous I. A. units have reported to this publication the success of their servicing drives. San Francisco, for example, reported the addition of six more theatres to its servicing list, although Erpi is reported to have signed one S. F. theatre group for its new all-inclusive plan.

Reports reaching this publication indicate that one of the sound com-

Who Says the Electrics Are Not In Equipment and Supply Field?

ERPI and RCA both disclaim any intention of entering the equipment and supply business in connection with their projected all-inclusive theatre servicing plans. One may accept these protestations at face value—because *both these electric companies are already engaged in the supply business!*

Appended hereto are the bids of both Erpi and RCA on an installation in Letchworth Village, Thiells, N. Y., on which four other supply dealers also bid. Neither of the electrics got the contract, but there can be no doubt that they not only stood ready to accept and fill it but were anxious to get it. Witness:

	ERPI	RCA
2 Projectors	$2375.00	$2651.19
1 Screen, 12 x 16	120.00	215.00
Sound system, if not built-in as part of the projectors.	3240.00	2166.00
Total	5735.00	5032.19

Certainly neither Erpi nor RCA will enter the equipment and supply field. They are already in up to their respective chins.

panies, in an effort to stem the rising tide of projectionist servicing activities, has utilized its district managers and field service men to spread a campaign of calumny against projectionists.

This campaign stresses the alleged incompetence of the projectionist not only in working on sound equipment but on visual projection apparatus as well. A record of service calls made at given theatres is produced, such records being indicated in every instance as resulting through the negligence of incompetence of the projectionist. In addition, the expenses for repair and replacement parts over the last few years are traced directly to the shortcomings of projectionists on the job.

In one town where this stunt was tried serious consequences were narrowly averted through the peacemaking efforts of the Union business representative. The net result of such activities is to make projectionists more determined than ever to rid projection rooms of itinerant service representatives of the electrics.

No further announcement anent servicing work has emanated from I. A. headquarters since the blunt announcement of President George E. Browne which appeared in these columns last month. It is understood, however, that work of coordinating the service activities of the various I. A. units throughout the country is proceeding satisfactorily, and that an announcement outlining the organization's national policy in this respect will be forthcoming shortly.

Preparations are underway in Washington for the impending investigation by a Senate committee of the communications companies, with the activities of A. T. & T., and its W. E. and Erpi subsidiaries, expected to occupy the spotlight. Manufacturers, dealers and projectionists, through their communications to Washington representatives, have helped to focus Congressional attention on happenings in the sound picture field.

Dealers Continue Campaign

Supply dealers throughout the country continued to strengthen their tie-ups with projectionist organizations and exhibitors, to the further discomfiture of the electrics. A topic of major interest on the program of the forthcoming meeting of independent theatre supply dealers in Chicago will be the threat to dealers of an extension of the electrics' influence in the theatre field.

Experience of various projectionist organizations in servicing work to date has proven conclusively that, in a majority of jurisdictions, one man can easily handle all servicing work, as contrasted with the plan of having each theatre serviced by its own staff. An assistant, or substitute, for the service man can be designated in case of emergency calls while the No. 1 man is engaged, or in the event of any other untoward circumstance.

Prints of practically every unit in the various sound reproducing systems now in use will be made available shortly by INTERNATIONAL PROJECTIONIST for distribution to projectionist organizations throughout the country.

LETTERS FROM READERS

(*Continued from page 4*)

put plan through, principally for shipping cases and exchange racks. Thanks for the orchids.—ED.

"ONE OF THE FIRST"

Herewith clipping from our home paper which may interest I. P. readers:

"W. Clyde Quimby, 54, pioneer motion picture man, is dead here (Fort Wayne, Ind.). . . . He was credited with having opened the first movie house in Ohio and one of the first in the world when on Feb. 7, 1905, he began operation of the 'Pictorium' in Dennison, Ohio. Later he operated movie theatres in Zanesville, Maysville, Lexington, Massilon, Columbus and Cadiz."

OTTO KAISER
Middletown, Ohio.

Thanks to Mr. Kaiser, sec. of Local 282 for foregoing. At twice its present size I. P. would have too few columns to accommodate all the claimants to honor of being "one of the first" to project pictures or operate theatres. Motion picture historian usually duck into bombproof cellars immediately after publication of their works.—ED.

BOSTON 'WIDE RANGE'

Am enclosing clipping from *Boston Sunday Post* which is an extravagant rave about the new Wide Range sound system in Metropolitan Theatre here. . . . Article cites range of from 30 to 14,000 cycles in theatre reproduction. Also states that radio broadcasting hits on up to 9,000 cycles—except at night.

JUST HORACE
Boston, Mass.

Well, Just Horace, nothing even approaching 14,000 cycles is *recorded on the film* delivered to the glorious Metropolitan. Of course, that crew might soak the reels in alcohol or something to pep up the frequency range. And if 14,000 cycles *were* on the film, it couldn't be reproduced, Wide Range or not.

We'll volunteer to eat any radio transmitter that today sends, at most, 6000 cycles—day or night. This topic is covered nicely by Leopold Stokowski in I. P. for January, 1935, p. 22.—ED.

I. P. CONQUERS IRELAND

Received my first copies of I. P. The first two numbers were worth several years subscription price. (Don't take me literally.) . . . Your recent articles on A. C. and D. C. arcs are the best I have ever seen. Well-informed fellows over here just can't see the necessity for the A. C. arc . . . Why not publish a complete history of the development of the carbon arc? . . . I can't think of a more interesting projection topic.

THOMAS O'CONNELL
Chief, Savoy Cinema
Cork, Ireland.

I. P. is now working on the conquest of Scotland. For abundant arc data we suggest latest National Carbon Handbook (adv.) and supplementary articles in I. P., notably "Characteristics and Uses of the Carbon Arc," by W. C. Kalb, in I. P. for October, 1934.—ED.

RCA Executive Changes; J. E. Francis to Coast

SEVERAL important changes in the directing personnel of the Photophone Department have been announced by RCA Victor Co. J. E. Francis, heretofore manager of the department, has been named manager of the company's Hollywood operations. Succeeding Francis as manager is Edward M. Hartley, former service manager, who in turn is succeeded by his assistant, F. B. Ostman.

J. E. Francis

Francis enters upon his new duties with the well wishes of a host of friends in the exhibition field, and in particular many projectionists with whom he enjoyed the most cordial relations. Francis is perhaps best remembered by projectionists for his fine work in connection with the RCA sound projection school.

News Notes

The so-called Fact-Finding Committee appointed by the NRA to establish a wage scale for N. Y. City projectionists has been dissolved and cross-picketing between the three N. Y. unions has been resumed duplicating the Sept., 1933, picture in every detail. (Ed. Note: This paragraph could have been written at anytime since the Committee was appointed, foreordained to failure that it was.)

W. E. net loss for 1934 is reported at $7,751,548. For the previous year the loss was $13,772,504. Erpi is a W. E. subsidiary unit.

I. A. profited through a recent deal arranged by Roger Kennedy of L. U. 199, when 59 projectionists were placed with the Jim Handy industrial film unit which will tour the country until next Dec. 10 for Chevrolet Motor Co. Film will be changed every three months.

Herewith text of Massachusetts measure to place stagehands under jurisdiction of Commission of Public Safety, as are projectionists at present:

"No person shall be employed or allowed

(*Turn to second page following*)

WHAT THE I. A. SAYS—

The General Executive Board of the I. A. will insist, without qualification, that the work (servicing of projection and sound equipment) be maintained by the members of its Locals.

SOONER OR LATER—

Every projectionist will have to assume responsibility for the servicing of all projection and sound equipment under his care. Therefore, the following announcement should be of vital importance to you.

SERVICING SOUND EQUIPMENT

by James R. Cameron

NEW SECOND EDITION

with a complete set of

TROUBLE-SHOOTING CHARTS

COVERS THE SERVICING OF—

- Motors
- Faders
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- Gain controls
- Filter chokes
- Sound screens
- Circuit wiring
- Exciting lamps
- Pick-up devices
- Volume controls
- Control cabinets
- Speed regulators
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- Power amplifiers
- Rectifier stacks
- Monitor speakers
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- Power supply units
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- Sound picture equipment
- High Fidelity equipment
- High Fidelity sound heads
- Resistance coupled amplifiers
- Transformer coupled amplifiers

256 pages .... over 100 diagrams

PRICE: $3.50

This new edition has been especially written and published to help projectionists in the servicing and trouble-shooting of all equipment under their care—sound equipment—projection equipment—electrical equipment. The book is brand new, has been greatly increased in size and number of pages.

OVER 100 WIRING DIAGRAMS THAT ARE NECESSARY IN "TROUBLE-SHOOTING" SOUND AND PROJECTION EQUIPMENT.

Many of these diagrams are published for the first time. They cover all sound equipment found in use today, including High Fidelity" and Wide Range".

NO MATTER WHAT TROUBLE YOU ENCOUNTER WITH YOUR EQUIPMENT—YOU CAN IMMEDIATELY FIND THE CAUSE AND REMEDY BY USING THE

TROUBLE-SHOOTING CHARTS.

Practically every trouble that can happen to your installation will be found listed in these charts. A separate chart has been prepared for each unit making up the installation. There are trouble charts covering sound heads, High Fidelity equipment, arc lamps, screens, motors, generators, carbons, projectors, amplifiers, speakers, etc., etc.

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CAMERON PUBLISHING COMPANY—WOODMONT, CONN., U .S. A.

to work as a master mechanic or a stagehand on any stage in the commonwealth during the period when a performance is being given until he has received a special or a first-class license to do so from an inspector."

Final disposition of the suit of Duovac Radio Tube and General Talking Pictures against A. T. & T., W. E. and Erpi will come before Federal Judge Nields in Wilmington, Del., on April 22.

I. A. has instituted new working conditions in N. Y. City. 306 men now working four days will be cut to three, and those working five will be cut to four days, in an effort to relieve unemployment. This move followed breakdown of Fact-Finding Committee efforts to set a wage scale. Both members and exhibitors have protested strenuously this further cut in the work week, former because of lost income and latter holding that projection will suffer as a result of frequent shifting.

Edward Harris lost his suit to compel L. U. 650 (Westchester, N. Y.) to reinstate him. N. Y. State Supreme Court found that plaintiff had not acted in the best interests of the union or of his membership in it when he allegedly attempted to negotiate independently for wages, the court holding that this is strictly the province of the union.

The late Thomas E. Maloy, former head of Chicago Local 110, left an estate of only $2,000, according to probate court records. Maloy is known to have held insurance, not subject to probate, of at least $50,000.

Two-men projection shifts legislation has been introduced in the states of Ohio and California. Several other purely local laws are also pending.

'It Can't Happen To Me'

Two projectionists were severely burned about the face and hands in a recent fire in the Warner Theatre, Hoboken, N. J. Fire broke out in the projection room, and the crew tried to check its spread. The audience left the theatre without injury.

Sixteen persons were killed in a fire which started in the projection room of a movie theatre in Perpignan, France. The fire caused a panic in the theatre, the deaths being attributed to the frantic rush for the exits which ensued. Among the victims were four children, the oldest 13 and the youngest 8.

The popular, new colored films are photographed in the snow-white light from National Motion Picture Studio Carbons. Perfect reproduction requires projection light of the same quality. Powerful light of superior quality and intensity for color and for improved black and white projection is now available for theatres of every size.

Use National High Intensity Projector Carbons

NRA CODE

NATIONAL CARBON COMPANY, INC.
CARBON SALES DIVISION, CLEVELAND, OHIO
Unit of Union Carbide and Carbon Corporation
Branch Sales Offices: New York, Pittsburgh, Chicago, San Francisco

DeVry Summer School Dates Announced

The DeVry Summer School of Visual Education, while organized originally for amateurs, now includes professional projectionists on its program. The course includes not merely training on the operation and care of the products made by DeVry but also goes into the deeper phases of electronics and modern sound systems. DeVry Summer School students are exceptionally high grade, being chiefly teachers and sales executives.

Among the interesting features will be daily exhibitions of outstanding films of the year and tours to Chicago's noted cultural centers. Mr. DeVry's yacht will again be in service on Lake Michigan.

This year the school will be held from June 24 to 28. Further details are available from A. P. Hollis, Director, 1111 Center Street, Chicago.

NEW PRESSURE EXTINGUISHER

A new 2-quart vaporizing liquid fire extinguisher that is discharged by air pressure and delivers a fan-shaped spray as well as a solid stream has been announced by the Pyrene Mfg. Co.

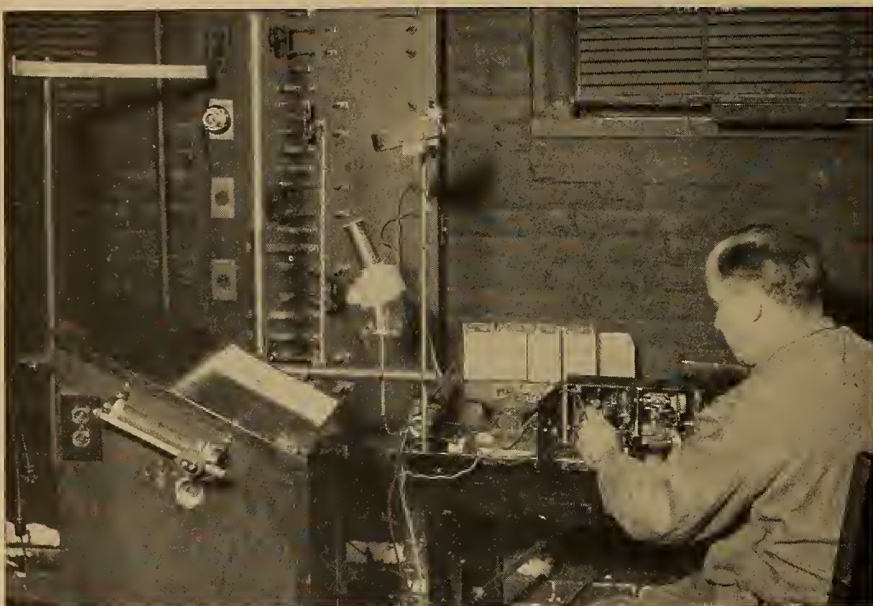
This extinguisher, known as the Pyrene 2-quart Pressure Type, is recommended for incipient fires in all classes of material, and especially for flammable liquids and electrical fires.

Unique Discharge Nozzle

The discharge nozzle is unique in that it produces a solid stream when opened wide, and a fan-shaped spray when opened partially. When the nozzle lever is released it serves as a temporary shutoff. The fan-shaped spray instantly vaporizes the liquid, thereby displacing oxygen and smothering the fire. It is especially valuable where there are well-filled containers having little or no room at the side of the container against which to direct a solid stream to break it up and atomize it.

HEADQUARTERS

for development of sound lamps



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SOME PROBLEMS OF MOTION PICTURE ENGINEERING

(*Continued from page* 19)

very foundation of this branch of engineering, namely, the photographic film, we can fairly ask whether the present film materials are the best that can be expected. Are they as durable, as economical, as well adapted to high-speed projection and intense heating, and as free from dimensional changes with time as may be desired? Has graininess been reduced to a completely satisfactory minimum (even for such special applications as process shots), and has speed been raised to the point where the cameraman is practically untrammeled in his work even under such favorable conditions as frequently challenge the newsreel worker?

Can we be said to have film that is suitable for color photography—that is, for the reproduction on the screen of the full colors of the photographed scenes? Has film susceptibility to other forms of energy than light been reduced to a minimum? Can we add to the already great accomplishments along these lines?

Camera Work Convenience

The engineer, contemplating the awkward structure of a blimped or sound-proofed camera (the camera itself being an object of considerable size and weight), wonders whether something more convenient can be contrived. Silence in operation, compactness, continual accessibility of all adjustments and simplification of such adjustments, and generally increased mobility present attractive possibilities.

Some workers are prepared to accept the theory that the optics of photographic lenses are not capable of basic improvement, but if some way to diminish the large number of lenses that are required in the studio for close-ups, medium, and long shots could be contrived, it would be a step forward. Zooming by more convenient and automatic means is desirable. And the present methods of achieving angle shots, following shots, and the like leave room for improvement, as any one must admit who has watched the operation of the mammoth cranes and dollies now in use.

Studio Lighting One of Most Important Problems

It may also be fairly assumed that the last word has not been spoken in studio lighting. Could not studio lighting be so arranged that each set does not require inevitably the shifting of practically every lighting unit? Could not a semi-standardized lighting plan be adopted under which the lighting could be controlled by manipulating a modern control board rather than by dragging tons of equipment around the studio? The control of the direction of incident

light, its amount, its diffusion, and its color (where that factor is of importance), all present to the engineer matter for further consideration.

Closely associated with such problems are those of make-up, set construction and finish, and costuming. It is possible that new materials will be found for set construction which will present a more desirable combination of optical, mechanical, and acoustical characteristics than those now available.

The recording of sound is well done, considered as a young art. But the evolution of more compact and lighter recording equipment, the use of more economical recording methods, the development of more convenient and simpler methods of editing and recording or "dubbing," and methods of recording that enhance auditory perspective are desirable.

When the processing of film by the laboratory is considered, it seems clear that a group of methods will be evolved whereby the precision and uniformity of the product can be further increased. Automatic processes are entirely in order in dealing with the vast quantities of film that are handled by a laboratory, and one may look forward to the time when everything, from exposure time and developer concentration and temperature to the condition and packing of the finished film, will be handled and controlled automatically. The devices for the purpose may even be provided with "checking controls", indicating when the control device in question is out of order and then providing a corresponding alarm.

By a simple extension of the thought, one can imagine film exchanges wherein the inspection of film and the repair of at least some defects can be automatic or semi-automatic. Considering the way in which film is sometimes mistreated by the user, one might facetiously add that there is need for a device that automatically charges the delinquent user for the damage he has done *and* also collects the full amount promptly and relentlessly.

Reproducing Problems

Closely related to some of the problems mentioned are those of the theater. Present methods of monitoring both picture and sound leave something to be desired. Substantially complete silence in the projection room is needed if convenient monitoring through large open ports is to be possible. In the meantime, a type of port that lets out light without absorption, but not sound, may be developed.

Screen illumination remains inadequate in some cases, and no standardized method of checking the condition of screens as often as may be desirable has been worked out. A simple and automatic method of so doing would be a help to the exhibitor whose entire salable output passes through the proscenium arch. The color of the projector illuminant and its stability and economy are under active study and merit such attention.

The reduction of film wear by appropriate construction of projectors and by automatic or semi-automatic supervisory methods presents a real problem. And needless to say, film breakage during projection is, in the engineering sense, entirely inexcusable. The projection of color pictures will bring in a number of new problems of projector construction, of screen surfacing, theater lighting, and other arrangements. If ever three-dimensional pictures are to be available, it is likely that a number of radical changes in theater construction and equipment will be involved.

The reproduction of sound in theaters has also steadily improved. Problems of increasing further the dynamic range of reproduction, of establishing *and maintaining* reproduction of improved fidelity, of achieving stereosonic reproduction (*i.e.*, sound reproduction with auditory perspective), and of reproducing speech and sound with equal satisfaction assuredly exist and invite further effort.

Closely associated with all the preceding is the general question of motion picture theater construction. Some architects skilled in the related problems have vigorously maintained that the present forms of theater design are not technically sound, and have proposed other more or less plausible substitute constructions. Speaking for a moment as a

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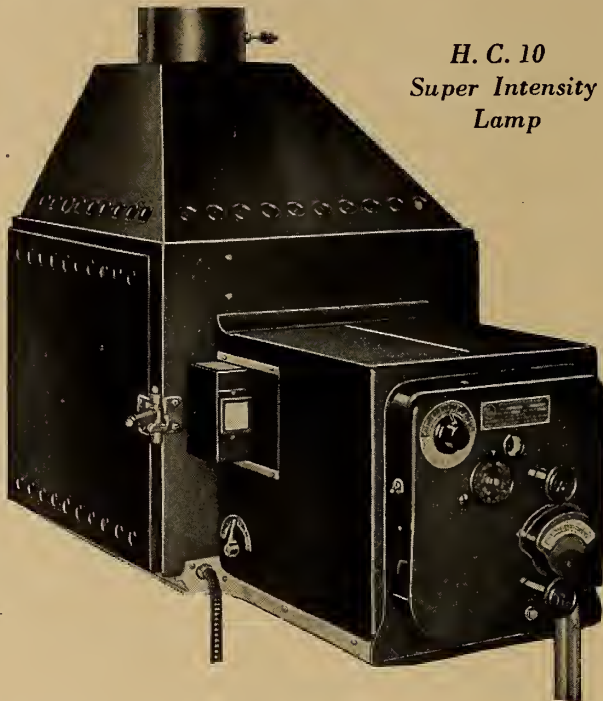

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theatergoer, something is certainly to be desired to permit the blinking and half-blind patron, entering a darkened theater from a sunlighted street, first to accomplish the difficult feat of locating an unoccupied seat and then to reach it with minimum damage to the footwear, other impedimenta, and good nature of the seated occupants of that row.

And, as has been clearly pointed out recently by a profound thinker, there is need for solving the old problem of the theatergoer who enters at the middle of a picture and has the weird experience of "enjoying" a slice of life that begins with the death of a character and ends with his birth. Perhaps even that puzzle has a partly technical answer.

An Open Mind Essential

As may have been gathered, all the preceding discussion is really more a plea for an open mind, willing effort, and resourcefulness on the part of the engineer than a complete technical summary of problems in the motion picture field. If you are satisfied that much has been accomplished and that much remains to be done, the purpose of this discussion will have been achieved. In that event, motion picture engineering will continue to be the loyal friend and tireless servant of the industry and the public, and will always, as now, deserve to be fostered and encouraged by the industry and the public alike.

Discussion:

Mr. Thoradson: You mentioned only camera lenses and various problems in connection with them. There is another lens that deserves attention. I am more and more impressed with the fact that the condenser is by no means what it should be, and that due to that fact we are wasting a great deal of light.

Mr. Schlanger: The difficulty of being able to find one's seat in the motion picture auditorium has been largely overcome. In the past, direct and spot illumination was used, and during the performance it was necessary to switch off the lights because of the distraction they caused in competing with the screen illumination. The proper

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intensity and color of evenly distributed indirect light will afford ample illumination for getting about the theater, and will not in any way interfere with screen definition or the ability to view the screen comfortably. Low chair, stair, and wall lights below the line of vision are effective also for auditorium illumination.

The problem of adjusting the eyes to the sudden change of intensity from that of the street to that of the auditorium is soluble in two ways: first, by a higher permissible intensity of light in the auditorium proper; and second, by having at least two intermediate stages of light intensity between the street and the auditorium, using the lobbies, foyers, or other spaces in the same way as compression chambers are used in under-water construction.

Mr. Bliven: I am quite interested in the reduction of sound through the projection port, and particularly of the audience's reaction to the noise of the projectors and the sound of the monitoring speaker. Serious work should be done on that problem taking into consideration the dimensions of the ports and projection room noises.

Mr. Thoradson: If the wall of the projection room is thick enough, say, 8 inches, and if the two sides of the port are faced with sound-absorbent material cut to the size of the light-beam, the sound should be considerably reduced. Such a scheme has been tried in a number of theaters, and has proven quite satisfactory.

Mr. Bliven: I have tried that, at the same time lining the interior with sound-absorbing felt, but it was not entirely satisfactory.

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COPPER OXIDE RECTIFIERS FOR ARC SUPPLY

(*Continued from page* 15)

signed as to allow for ample heat-dissipation when it is old.

Through proper design of cooling fins, proper grouping of disks and the use of a blower (in this case a small fan) to carry off the heat as fast as it is generated, it is possible to rectify currents of high amperage with a comparatively small copper-oxide unit.

The copper-oxide rectifier, as designed for arc current supply, consists of a transformer bank connected delta hookup to a three-phase A. C. supply line. The transformers reduce the incoming A. C. voltage to the voltage required by the rectifier. This secondary voltage can be regulated to satisfy the particular requirement by means of a group of secondary taps brought out to a terminal board on the rectifier.

The primary, or output side, of the transformers is also provided with taps to adapt the rectifier to the particular line voltage of the installation.

In the copper-oxide rectifier there is a magnetically-operated switch which will close or open the main three-phase supply line feeding the transformers. The magnetic coil which actuates this switch is connected through a mercury switch actuated by the blower (fan), so that if for any reason the blower should cease operating (and thus cease cooling the unit), the input current to the rectifier would be instantly cut off. This is a particularly advantageous feature to protect the rectifier from possible damage.

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The blower (or fan), is of a special ball-bearing type and is factory lubricated in such a manner that it will require absolutely no attention for several years. One such fan has been running on test constantly for the past five years in the outside air where it is subjected to the rigors of cold winters and hot summers year after year, and no attention whatever (not even lubrication), has been accorded it.

The copper-oxide unit consists of a bank of units so connected into a three-phase network that all three phases are rectified. The 60° phase angle between

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each phase results in an output of direct current that is smooth and substantially without ripple, thus assuring steady, flickerless projection.

The rectifier units are so mounted that the blower completely and more than adequately ventilates them by means of a continuous air stream which assures maximum cooling. The housing for the complete assembly, which is of steel, is so designed as to insure maximum cooling of both the copper-oxide units and the transformers. No heat issues from the rectifier, but only a cool breeze.

Copper-oxide rectifiers are designed to serve as a power supply for the new Suprex carbon arc lamps at any desired current from 40 to 65 amperes, and 30 to 35 volts. Smaller or larger assemblies can be built to specification, of course.

The outstanding features of the copper-oxide rectifier are : (1) overall efficiency comparing favorably with other means of arc current supply; (2) the absence of moving parts, except for the small fan which has been demonstrated to require absolutely no attention for a period of several years or more; (3) no maintenance costs, whether for repairs, bulbs or other replacement parts, and (4) durability and long life even under the most severe and prolonged operating conditions.

The copper-oxide rectifier constitutes one of the most satisfactory sources of power supply for projection arcs—whether judged on the basis of either or both efficiency and economy.

[NOTE: Additional information relating to the copper-oxide rectifier, or any other item of projection equipment, will be supplied upon request.]

A MODERN WEAPON TO FIGHT TUBERCULOSIS

(*Continued from page 14*)

much certainty by the application of the principles which underlie the therapeutic measures in everyday practice for the treatment of tuberculosis.

Basic Curative Measures

Because breathing must be carried on and the blood must continuously circulate through the lung, rest to the lung can be applied only to a relative degree. Yet we can make the lung fairly safe from extensions of the disease and from the serious destruction of tissues by using the full amount of rest possible.

We breathe only to oxygenate blood. We require only the amount of blood oxygenated that is vitiated by body activity. Therefore, by putting the patient at rest and stopping unnecessary body activity the least amount of blood is vitiated and the smallest amount of oxygenation is required.

To show how sensitive the body response to exertion is, it is only necessary to know that if a patient sits up, as

on a chair, instead of reclining, as on a couch, he uses twenty percent more oxygen and must breathe twenty percent faster or deeper in order to supply it. If he walks across the room, it takes from six to eight times as much blood in the muscles for the exercise as it does for the muscles at rest. This means more rapid or deeper respiration, and greater activity in the lungs.

From this it readily can be understood to what extent activity is forced onto a lung by the ordinary exertions of life. That is why bed rest is so valuable in checking destruction and preventing the spread of tuberculosis.

A further reason for bed rest is found in instances where the tissues are softening and giving out toxins. Increased movement of the lungs and increased flow of blood through them increases the absorption of poisons. The poisons produce harmful effects upon the body, causing nerve instability, tiredness, loss of appetite and weight; decreasing endurance and strength; producing a rise in temperature, and causing anemia. Increased movement also increases cough and expectoration.

It can now be seen that rest alone will put the patient in a favorable condition for cure. Rest, however, is only one of many important aids in cure for the patient.

Complete Rest Necessary

Brehmer, in establishing the first sanatorium, utilized all of the important principles that we use today in the treatment of tuberculosis, with the exception of rest. By removing the patients from their homes where they were surrounded by domestic and business cares; by isolating them in a special institution where a helpful atmosphere was created by the medical staff; by placing them under hygienic conditions with much time spent in the open air; and by giving them an abundance of good food and keeping them under constant medical supervision and control, he produced the best results that had heretofore been attained.

Apparently he had no conception of the value of rest, which has now become the cardinal principle of modern treatment. It required fifty years of treating tuberculosis to elevate rest to the first place in therapeutic measures.

Recently we have learned that we can successfully treat many cases which formerly baffled our skill by applying local rest to the lung. This is done by keeping shot bags on the lung. Pneumothorax, phrenic operations and thoracoplasty, all these have become important parts of the modern treatment of pulmonary tuberculosis.

The application of the principles of rest, isolation and control of the patient, hygienic living, good food and intelligent medical care, fortified when necessary by the principle of local rest to the lung, should crown the early diagnosis and early treatment campaign with its fullest accomplishment. Furthermore, early diagnosis and immediate adequate treatment will bring about cure in a minimum of time, with a minimum of expense and restore the patient to society with a minimum loss of efficiency. At the same time it will serve the purpose of preventing the spread of the disease by reducing to a minimum the time and severity of exposure.

In other words, we must have early diagnosis and immediate adequate treatment to get the best of tuberculosis.

LOCAL 380 ANNIVERSARY

The 20th anniversary of Local 380 of Oklahoma City, Okla., was observed on Feb. 15 with a banquet which was attended by representatives of the following local unions: 227, Ponca City; 246, Muskogee, 513 and 354, Tulsa; 387, Lawton; 399, Bartlesville; 471, Okmulgee; 517, Sapulpa; and 112, Okla. City.

From out of the state were members from 414, Wichita; 641, Arkansas City; 455, Fort Smith and 673, Lubbock. Attendance was 115. An expansive spread preceded a fine program of entertainment and dancing.

The newly formed Oklahoma State Assoc. of I. A. units is progressing very nicely, according to word from I. A. rep., Felix A. Snow, who is attending each session. A 100% representation throughout the State is anticipated shortly.

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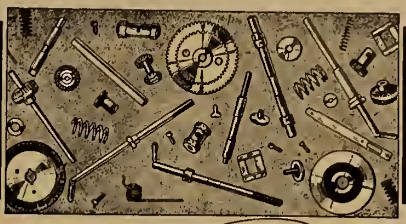

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TELEVISION IN 1935

(*Continued from page* 10)

home television onlooker) will be on the fifty yard line. This year, of course.

Sad to relate, Mr. Harris forgets that the scanning area of even the most advanced television system of today is so restricted as to make it difficult to encompass with any degree of fidelity even a room 12 by 12 feet. Certainly a televised football game would today give the home television enthusiast a seat on the fifty yard line—straight out across the line for about 5 yards and an equal distance either side of the line.

Furthermore, if television will "pu!' 90% of our population into their own parlors," where will all these events, sporting and otherwise, look for their patronage at the gate or the box-office? Mr. Harris evidently has all this figured out in terms of subsidized programs by big national advertisers. Really? Well let's have another look into Dr. Goldsmith's article on this topic. Witness:

"In a general way it may be stated that the problems of telephone broadcasting (radio), as we know it today, are not one-tenth as difficult as those of television—and perhaps the fraction just mentioned should be one-hundredth! . . . One of them is the difficulty of securing the necessary supply of programs and artists.

"We all know that Hollywood, with considerable difficulty, secures the necessary hundreds of stories each year which are put into the form of feature pictures. Is there any likelihood that radio television can secure more hundreds or even thousands of acceptable stories or plots around which acceptable television programs can be built?

"Again, Hollywood retains, at allegedly vast salaries, that limited group of actors and actresses who have both eye and ear appeal. How scant the acceptable supply actually is has been repeatedly emphasized by the chief motion picture producers . . .

"Even supposing that program material and artists were available, where shall be found those ultra-prosperous advertising sponsors . . . who can afford to pay a substantial portion of the cost of a feature-film production for an hour's broadcasting?"

And there we have it. Mr. Harris further indulges himself by considering *in extenso* such questions as whether there would have been a depression in 1929 had television been let loose on the market in that year. The answer is that there would have been a depression just the same, plus the added misfortunes of those "suckers" who went for television in 1929—and in 1935, too, Mr. Harris.

Future Development

There is no attempt herein to wave away the accomplishments of television workers to date, no attempt to convey the impression that ultimately television will not rank with radio broadcasting, as we know it today, as an acceptable means of communication and amusement. "Ultimately" is the precise word.

But to forecast the arrival of television in 1935, in the face of expert opinion directly to the contrary and in the light of present financial and technical problems which are staggering even to contemplate, much less tackle—to go off on a publicity spree of this sort at present is to do television a disservice of a sort from which the art has already suffered too much. Least appreciative of such "puffs" are the earnest television workers who after years of sincere and tedious labor themselves are the first to emphasize the magnitude of the task still confronting them.

It does not follow from the foregoing that workers in the amusement field should be contemptuous of television and of its place among the highly important branches of the electronic arts of the future. It is highly desirable, in fact, that these workers keep themselves posted on the steady advance of the art.

Such contributions as those previously cited, however, should be carefully weighed in the light of known facts, the dissemination of which will always be one of the chief functions of this publication.

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THREE—DIMENSIONAL MOVIES . . . ANALYSIS OF AMPLIFIERS . . . THE SERVICE SITUATION . . . PROCESS PROJECTION SHOTS . . . NEWS NOTES

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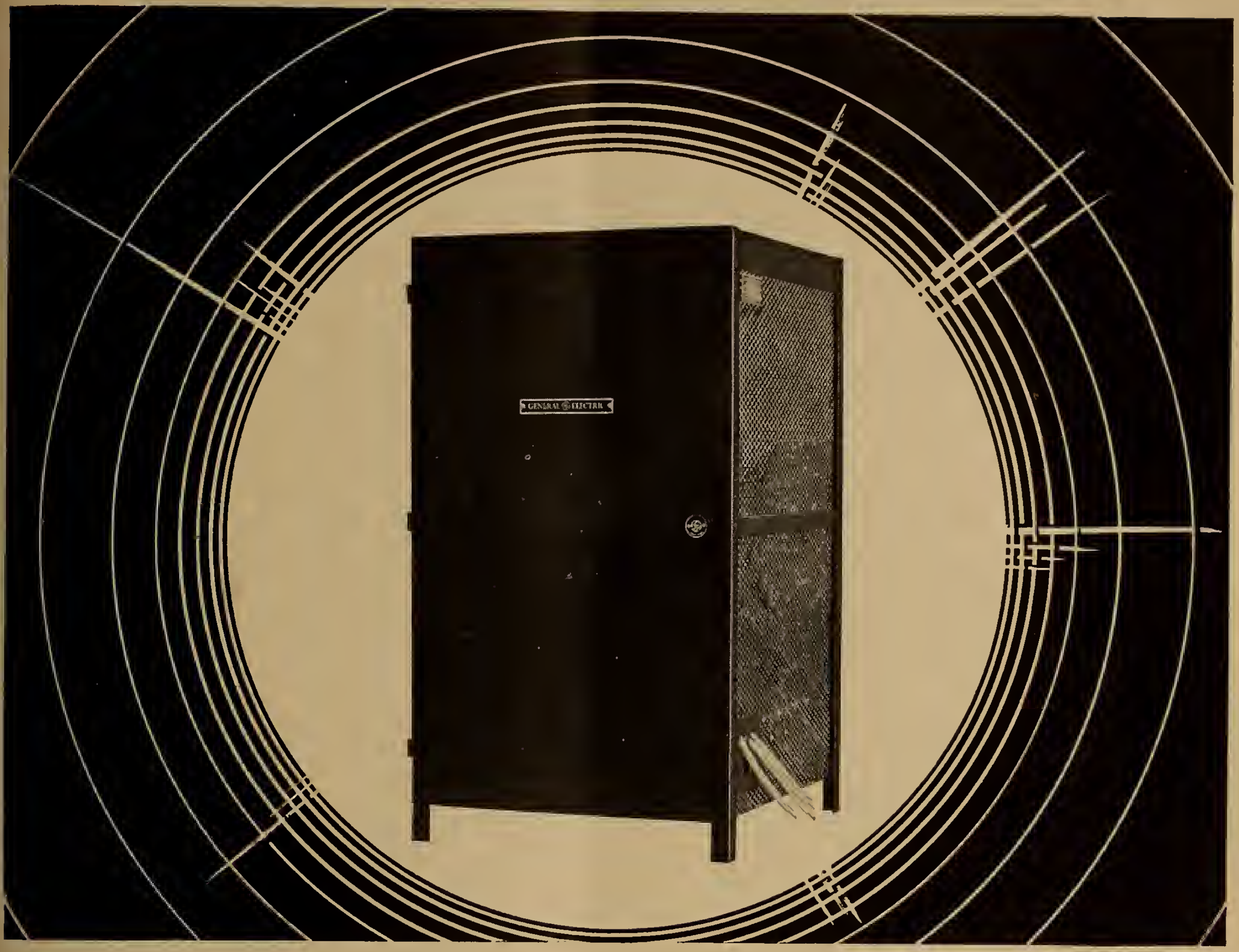

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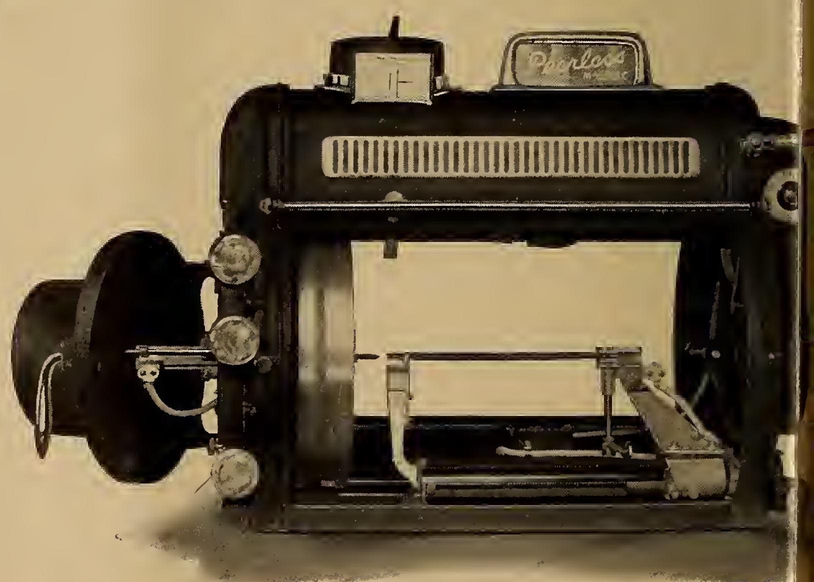

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"THE WORLD'S LARGEST MANUFACTURER OF PROJECTION ARC LAMPS"

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 8 APRIL 1935 *Number 4*

Index and Monthly Chat 5

Step-by-Step Analysis of Sound Reproducing Equipment, IX 7
AARON NADELL

Questions and Answers on Sound Projection 10

Three-Dimensional Movies 'Re-Invented' by Lumiere 11

Erpi Widens Service Fight; Attempts to Minimize and Misrepresents Craft Opposition 12
JAMES J. FINN

More Erpi Service Propaganda 13

In Answer to Erpi's Claim of No 'Official' Craft Opposition 14

The Editorial Page 15

Corrective Action on Print Footage by SMPE and MPPDA 16

Background Projection for Process Cinematography 17
G. G. POPOVICI

Mr. Hoffman Replies: 'Costs—Initial and Operating—Favor the A. C. Arc'. 18

Another Opposing Vote on L. I. Lamp Conversion 19
J. E. MCAULEY

Arc Data Summary 19

Proper Screen Selection 20
J. C. HECK

Generators, Rectifiers and Bulbs 20
JOHN HERTNER

News Notes

Technical Hints

Miscellaneous Items

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420

MONTHLY CHAT

SEVERAL requests that we publish herein the footages of features and short subjects having been received, we should like to have the reaction of a representative cross-section of readers to this proposal. An effort to interest the exchanges in a means for marking prints is being made; but should such efforts fail, and should a sufficient number of readers desire it, I. P. is prepared to render such a service. How about it?

STRENUOUS efforts have been, and are being, made to prevent the egress of projection room noises to the theatre auditorium. Whether the craft knows it or not, this is one of the most serious defects in the reproduction process. Bluntly, it's damned annoying (particularly when a fellow wants to sleep through a given film program). Seriously, though, most of the noise emanates from spot and other ports which are carelessly left open, and very little noise gets through the projector ports.

This topic has interesting angles. Certain projectionists inform us that open ports are their only means for insuring ventilation, and that a little auditorium noise is very much of secondary importance thereto. Apart from this, we expect to announce soon the perfection of a tongue suppressor which we firmly believe will practically eliminate this trouble.

MUCH loose talk about motion pictures in color is being distributed throughout the industry, with the technically ignorant writers for the general trade press being the worst offenders. We've seen a lot of colored pictures, but outside of the Disney cartoons, we still wouldn't give a nickel for any colored picture alongside a good black-and-white effort.

TO FORESTALL further inquiries from palpitating subscribers the following announcement is made: With the next issue of I. P. will also be mailed the Special Review Number—a swell job editorially and (we hope) advertisingly. All congratulatory messages and words of praise will positively be printed—at space rates.

WE LEARN from the newspapers that the NRA likely will be extended for another two years. Does anybody in the picture business really care? Just look at the swell job NRA did in New York City within something less than two years. *You* look at it; we can't bear to.

WEST COAST projectionists might with great benefit to themselves attend a few sessions of the S. M. P. E. Convention in Hollywood. May 20-24. This is a once-every-five-years show for California.

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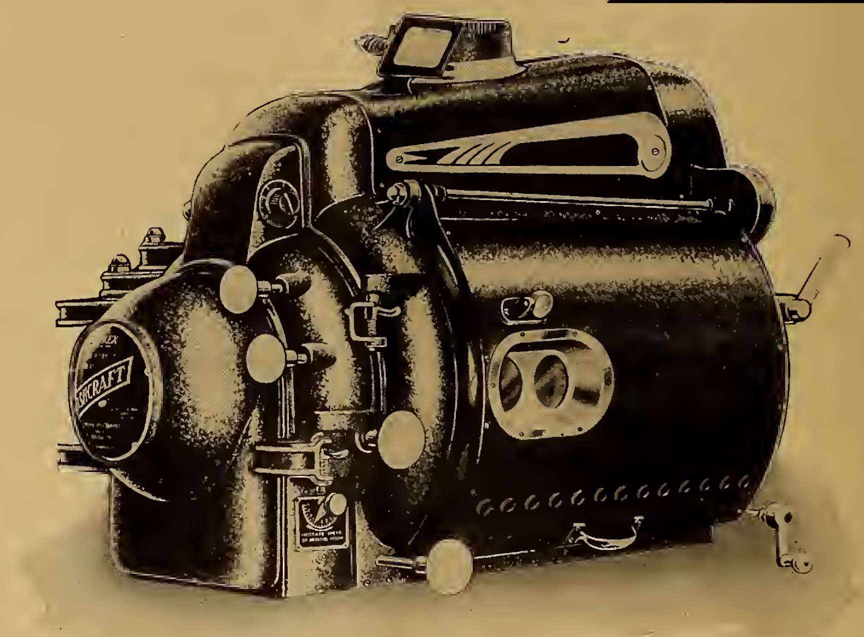

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INTERNATIONAL PROJECTIONIST

VOLUME VIII NUMBER 4

APRIL 1935

STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING EQUIPMENT

Aaron Nadell

IX. RCA Modern Power Amplifier

FIGURE 1 is the circuit drawing of a single-stage power amplifier, used in modern sound systems to provide the final step of amplification between a voltage amplifier and the loud-speakers.

Power input is shown at the lower right-hand edge of the drawing, just below and to the right of the long terminal board, by the two arrowheads labelled "60-cycle A.C. supply." Below and just to the left of these arrowheads is a rectangle drawn in dashes, which contains the time-delay starting relay.

Beginning at the lower arrowhead we may trace downward, left, up through a coil, right, and up to the upper arrowhead. That coil is the solenoid, or magnet coil, of the starter relay, and there is no switch in its line. As long as the external switch to the amplifier is closed, this coil remains energized. Its work is to pull and hold down the plunger arm that is drawn through it, thereby closing the contacts seen above the coil and within the rectangle of dashes.

The purpose of this relay is to apply plate current to the tubes automatically after the filaments have had time to heat up, which in practice is about thirty seconds. The delay action in the type of relay shown in Figure 1 is created by motion of the plunger in a sealed chamber containing gas. The slowly-moving plunger presses against the gas, which makes room for it by escaping through an asbestos membrane into an adjoining chamber. The time required for the gas to get out of the way gives the filaments time to heat and, especially, gives the mercury in the rectifier tubes time to vaporize, thus avoiding any possibility of a short-circuit in those tubes through the presence of liquid mercury.

The time-delay relay in some amplifiers of this type does not depend upon the action of the plunger in oil, but upon the curvature of a heating element. All metals expand under heat, some more than others. If a strip made of two metals of different expansion rates is heated, it will curl, the metal that expands more being on the outside of the curve, and the one that expands less on the inside. Thermometers are sometimes built on this principle, especially for high temperature work; and so are the automatic relays that shut off a flat-iron when it becomes hot enough, and heat it again when it cools.

In some amplifiers of the type of Fig-

•

Note: Figure 1 of this article appears on the second page following.

ure 1, the starter relay contains a "time-delay element" of such construction. Current is passed through that element, heating it, and causing it to bend until it closes the same contacts that the plunger closes in Figure 1.

Voltage Control Switch

Immediately to the left of the time-delay relay is seen the "110-120 Volt Switch", S-1, a double-pole, double-throw switch with a fuse connected across its blades. As shown in the drawing, the switch is thrown to the low-voltage side.

We may trace the circuits of this switch, and the remainder of the 110-volt line, as follows:

Beginning at the upper arrowhead of the line power input at the right of the drawing, left and then upward to the top of the primary winding of the filament power transformer, T-10. From the tap near the bottom of that winding right, down, right, down, left through the upper blade of the switch, up and right to the lower arrowhead. The bottom terminal of the primary winding of the filament power transformer, T-10, is then open-circuited at the left-hand side of the voltage control switch.

The plate power transformer circuit can be traced similarly: from the upper arrowhead of the power input down, left and up to the right-hand contact of the time-delay relay. Through the cross-arm of the plunger to the left-hand relay contact. Thence left, down and left through S-2, the "safety interlock switch" that open-circuits the high-voltage transformer when the cover of this amplifier is removed. (Remember that this switch does *not* afford complete protection; a high-voltage charge still is stored in the filter condensers and must be removed by short-circuiting them.)

From the left-hand side of S-2 left, up and left to the bottom terminal of the primary of T-12, the plate power transformer. From the tap connection near the top of that transformer right, down and right to the lower blade of the voltage control switch, S-1. Left through this blade, up through the fuse and right to the lower arrowhead. The top terminal of the plate transformer primary is then open-circuited at the left-hand side of the voltage control switch.

Filament Circuits

When switch S-1 is thrown to the left, for 120-volt input, the blades that now extend rightward from either side of the fuse run leftward instead, the tap-connections of both primaries are open-circuited, a larger number of turns are operative in each primary, and consequently a lower voltage is developed in all the secondaries, compensating for high line voltage.

T-10, the upper of the two power transformers, supplies all four filaments of this amplifier. The lowest of the three secondaries of T-10 provides current for the two rectifier tubes, 8 and 9, which are RCA 866's, mercury-vapor rectifiers. The middle secondary of T-10 lights the filament of Tube 7 through its arrowhead terminals, which connect to the arrowheads of that filament. This method of drawing filament circuits reduces the number of wires shown in the drawing and makes it easier to follow.

The right-hand arrow-point of the filament of Tube 7 does not make electrical contact with the wire drawn just above it. The filament circuit of this tube is exactly the same as that of its push-pull partner, Tube 6, and the arrowheads of each connect only to the appropriate arrowheads of their power transformer secondaries. The top secondary of transformer T-10 lights the Tube 6 filament.

Plate Power Circuits

Plate power for this amplifier is derived from the secondary of T-12, through the full-wave mercury-vapor rectifier composed of Tubes 8 and 9. The outer ends of this secondary winding go to the plates of the two rectifying tubes, the return being to the center-tap.

Tracing from whichever end of the secondary of T-12 may be positive at the moment, the circuit runs to the plate of the corresponding tube. Thence (from positive to negative) across the mercury-vapor to the filament of that tube. Thence to the filament transformer secondary, the bottom secondary of T-10. From the center-tap of that secondary left about two inches to join a line running upward. (Just below and left of this junction are the two filter condensers, C-29 and C-30, bridging across to the negative side of this circuit.)

The line we are now tracing runs upward, right, up, and right to the center-tap of the amplifier plate transformer, T-8. From the top terminal of this transformer to the plate of Tube 6, and from its bottom terminal left, down, left, down, left and up to the plate of Tube 7.

Thence from the center-tap of the top secondary of T-10 left, up and left to the right-hand side of R-36. Through R-36 and R-34, and downward to the ground connection, just left of the jack, J-4. Through the other ground connection seen just right of J-4 and a bit below it, right, down, left past filter-condenser C-29, down through filter-choke L-20, down past filter-condenser C-30 and through filter-choke L-21; down, right, up and right to the negative terminal of the rectifier which is the center-tap of T-12 secondary.

The rectifier filter chokes are in the negative side of the line, the filter condensers, as usual, bridging across the line from positive to negative. The line is not grounded either at negative or at positive, but between, at the point between resistor R-34 and filter-choke L-20.

The return from the other tube, Tube 7, is identical, and rejoins the circuit we have just discussed at the ground connection, having separated from it in the primary of T-8. We may trace it from the filament of Tube 7 to the middle secondary of T-10; from the center-tap of that secondary left, down a joggle, left to R-37, through R-37 and R-35 to the ground connection drawn just left and above J-4. In at the ground connection right and a trifle below J-4, right, down, left and down through the filter chokes, as already traced, to the mid-tap of the secondary of T-12.

Jack J-4 is normally closed, "shorting" the 2-ohm resistor, R-35. A millivoltmeter, wired to a suitable plug, is plugged into this jack for the purpose of reading the plate current of Tube 7. When this is done the millivoltmeter forms a parallel path around R-35. Directly above R-34 is a similar jack, J-3, which is used in the same way to read the plate current through Tube 6.

Resistor R-34 is marked as having 2 ohms resistance; R-35, although not described by the drawing, is of the same value. Consequently, by Ohm's Law every millivolt shown by the meter plugged into these jacks indicates ½ milliampere of current in the resistor. $I = E/R$: therefore with a one millivolt reading the current would be E (1/1,000) divided by 2 (2 ohms), or 1/2,000 amperes, or ½ milliampere. Since normal space current for these tubes is between 60 and 75 milliamperes each, correct reading on the millivoltmeter plugged into these jacks is from 120 to 150 millivolts, or .12 to .15 volts.

Grid Bias Circuits

The grid bias of the amplifying tubes of Figure 1 is obtained by means of the voltage drop in the two 2,000-ohm resistors, R-36 and R-37, together with the unimportant fraction of a volt drop in R-34 and R-35. The grid bias is therefore derived from a voltage drop in the plate circuit return.

Tracing the grid bias part of that circuit in Tube 6, from positive to negative: from the filament of Tube 6 to the upper secondary of T-10; from the center-tap of that secondary left, up and left through R-36 and R-34; from R-34 left and downward to the ground connection; then in at the ground connection shown just to the left of Tube 6, upward through R-31 and through the upper half of the secondary of T-7, and right to the grid of the tube.

The grid is then negative with respect to filament, by virtue of the drop in R-36. Assuming 60 milliamperes space current in R-36, the grid bias of this

tube is (E=I x R) 60/1,000, which is 60 mils, times 2,000 ohms, or 120 volts.

The grid bias of Tube 7 is traced similarly: from the filament of that tube to the middle secondary of T-10; from the center-tap of that secondary left, down and left to R-37; through R-37 and R-35 to ground; in at the ground connection seen just left of Tube 6; down through R-32 and the lower half of T-7 secondary; down and right to the grid of Tube 7 which then is negative with respect to its filament by the extent of the voltage drop in R-37.

Since the space current of this tube is the same as that of Tube 6, and since the value of R-37 is the same as that of R-36, the bias of this tube is also 120 volts.

The Speech Circuits

Figure 1 is a power amplifier often used in connection with the voltage amplifier analyzed by Leroy Chadbourne in I. P. for January, 1935 (page 14) and designated as Figure 2. Consequently, the speech input to Figure 1 of the present article is the output from Figure 2 of the Chadbourne article.

The latter drawing showed three output wires—at terminals 1, 2 and 3 of the terminal strip—in its lower left corner. Figure 1 of the present article shows three input wires—from terminals 6, 7 and 8 of the terminal strip—in the upper right corner.

However, when the two amplifiers are connected as in the average theatre use, terminals 1 and 3 of the Chadbourne amplifier are wired directly to terminals 6 and 7 of the present Figure 1. Terminal 8 of Figure 1 and terminal 2 of the Chadbourne amplifier are thus not used, being provided by the manufacturers to make possible impedance match when different amplifier combinations are required.

The input to Figure 1, then, under usual theatre conditions, is to terminals 6 and 7 of the connection block in the upper right corner, which means to the bottom and then to the tap terminal connections of the primary of input transformer T-7. This gives a 500-ohm input. The upper end of that primary is then open-circuited at terminal 8 of the connection block.

Jack J-2, seen just to the right of meter Jack J-3, is for a headphone test. In cases of no sound, for example, headphones plugged into J-2 will indicate at once whether sound is reaching this amplifier, or whether the trouble is between the input of this amplifier and the photo-cell. There is a similar test-jack in the output circuit of Figure 1, drawn just below the core of the output transformer, T-8. By means of these two test jacks and a pair of good headphones it is possible to tell at once whether loss of sound or disturbing noises or hums have their origin in this amplifier, or before it, or beyond it.

The secondary of input transformer T-7 is wired in a typical push-pull circuit, the upper terminal going to the grid of Tube 6, while the lower terminal may be traced right, down and right to the grid of Tube 7.

The a. c. component of the plate circuit of this amplifier may be traced, conventionally, from the plates to the filaments of either tube as follows: through the primary of T-8 to its mid-tap; thence left, down, left, down and left through condenser C-29 to the ground connection; in at the ground seen just left of jack J-4 and through the grid bias resistors to the filaments of the tubes.

A portion of the plate current swing is, however, absorbed by condenser C-28, which is drawn somewhat to the left of Tube 7 and just between R-36 and R-37.

When the grid of Tube 6 swings negative, reducing the plate current through that tube, a portion of the current through R-36 is absorbed by the top side of condenser C-28. A corresponding number of free electrons are repelled from the lower side of C-28 and go to swell the space current of Tube 7, which is, of course, increasing while the space current of Tube 6 declines. Thus the current through R-36 does not greatly decline, and the current through R-37 does not greatly increase.

During the next half of the speech cycle the current through R-6 rises, and some of the electrons it needs are provided by the upper side of C-28, instead of through R-36. A corresponding portion of the current through R-37 is then absorbed by the lower side of C-28, thus

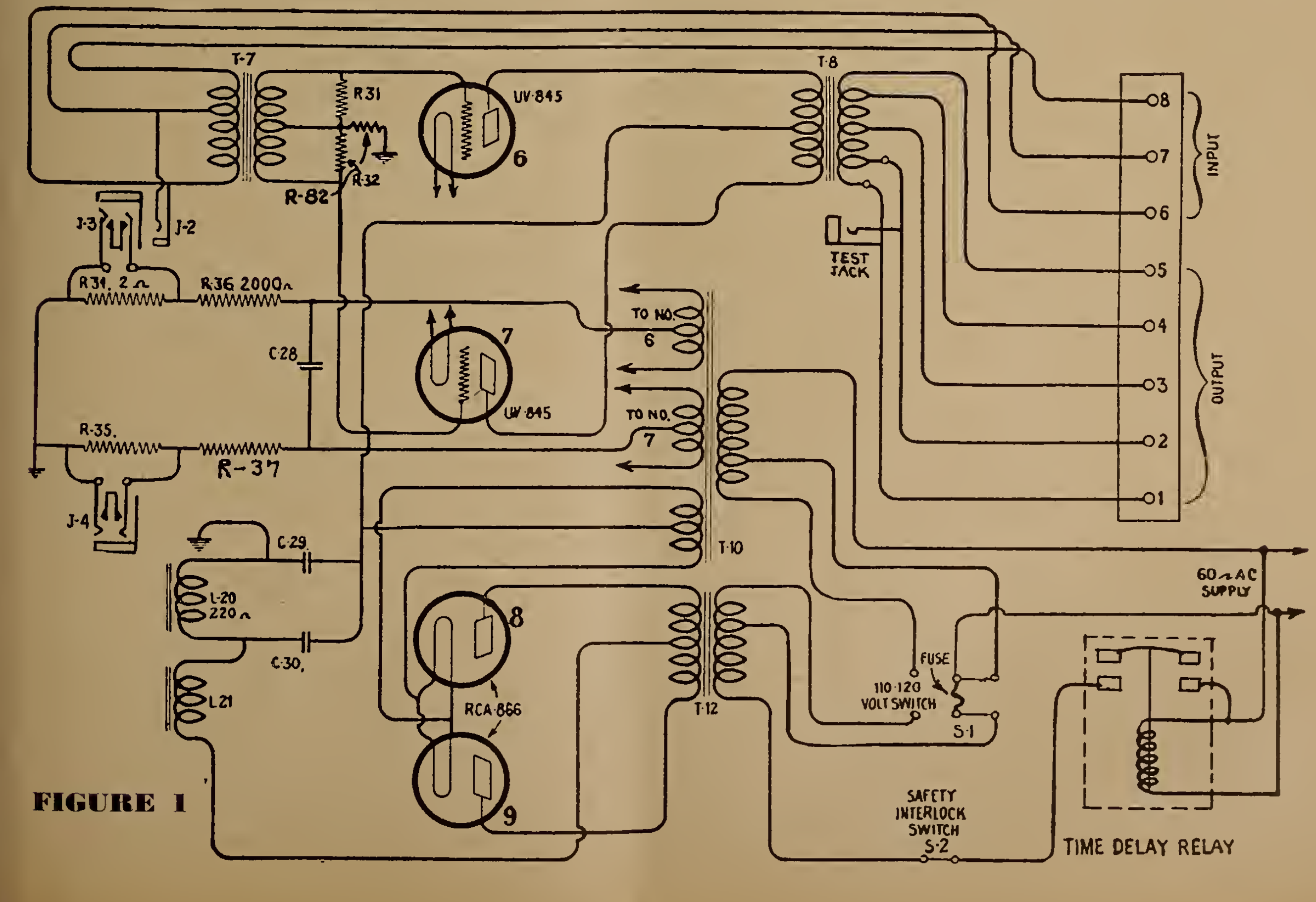

FIGURE 1

preventing a decline in the current through R-37 to match the falling off in Tube 7 space current.

C-28 then, acts to steady the bias current through R-36 and R-37, and thereby to prevent any distortion that might occur if fluctuations in the space current of each tube were permitted to cause a corresponding change in the drop through the two grid bias resistors.

Consequently, we may trace the a. c. components of the two tubes separately, as follows:

Tube 6: from filament to plate; through the upper half of T-8 primary; from the mid-tap of that primary left, down, left, down, left through C-29; through the ground connection; then, branching, one part through R-34 and R-36 to the mid-tap of Tube 6 filament secondary, and the other part through R-35, R-37 and C-28 to the same destination. (The next speech alternation, of course, takes the opposite direction through C-28.)

Tube 7: from filament to plate; thence down, right, up, right, up and right to the lower half of T-8 primary; from the mid-tap as before to the ground connection left of J-4; from the ground one part of the current goes directly through R-35 and R-37 to Tube 7 filament secondary, while the other part reaches the same destination through R-34, R-36 and C-28.

At the next speech alternation the current is from filament of Tube 7 to filament transformer; from the mid-tap of that to the right-hand side of R-37, where the circuit branches, one line continuing through R-37 to ground, while the other is then traced upward through C-28, and then through R-36 and R-34 to ground. From ground back through C-29 and thence to the plate of Tube 7.

Since the a. c. component of Tube 6 is at all times 180° out of phase with the a. c. component of Tube 7, the two a. c.'s always flow through C-28 in the same direction at the same moment, and never oppose each other in that condenser.

The output circuit of Figure 1 is drawn from the secondary of T-8, and wired to terminals 1 to 5 of the connection block at the upper right-hand corner. Impedance match to the speakers or to a speaker-matching transformer is obtained by choosing a suitable combination of these terminals.

There are 30 ohms between terminals 1 and 5, and three ohms between terminals 1 and 2. The test jack is connected across terminals 1 and 2. It will function regardless of whether or not those terminals are used for output power, since an alternating voltage will still be generated in the portion of the transformer secondary that they bridge, and current will flow in a headset plugged in across them.

Questions and *Answers* *on Sound Projection*

Aaron Nadell

NOTE: This department is launched in response to numerous requests by readers for such a service. The worth of this section, which will be a monthly feature, depends wholly upon the cooperation given by readers: the more numerous the inquiries, the more varied the department and the greater its value. Correspondents are requested to be specific and as brief as possible. Only initials will be appended to questions.—EDITOR.

Q. What causes a black, tarry stuff to leak out of some parts of an amplifier, and does this do any damage?

A. This black material is a sealing and insulating compound that has been softened by overheating. Line voltage may be too high. Loss of this compound, if not excessive, probably will do no harm.

Q. My amplifier works almost as well with one of the tubes removed, if I raise the volume control. In case a tube goes bad, is it all right to operate this way in an emergency?

A. Not unless you want to risk burning out the power transformer or the filter condenser. Stock enough spares. The tube you refer to is one of a push-pull pair, and the amplifier works without it at less than half volume and with inferior quality.

P. A. System Amplifier

Q. On amateur nights we use a microphone through the sound amplifier and speakers. How large an amplifier would I need to make a separate P. A. system, and how much should this cost? We have 400 seats.

A. An amplifier with 5 watts output should be large enough. If you use only one "mike", a new amplifier and speaker will not prove expensive. Consult your local supply dealers for lowest prices.

Q. My No. 1 projector accelerates to full speed in four seconds; but No. 2 requires ten seconds, although it runs alright once it is up to speed. What causes this, and how can it be corrected?

A. Switch motors to find out whether trouble is in motor, in the projector head or in the sound drive. Examine motor for bad brush contact, ineffective lubrication caused by a clogged oil hole or some similar condition, or any open-circuited starting winding, according to the type of motor.

If trouble is in the projector, look for insufficiently lubricated shafts or bearings, evidence of wear, or improper line-up in the head, in the sound attachment or the driving gears or pulleys. Repair may involve overhaul of the projector or sound head.

Q. I want to add another speaker. How can I be sure that I have kept impedance match?

A. Obtain from manufacturers the impedance of each speaker voice coil and the output impedance of the amplifier. Wire the speakers in series, parallel or series-parallel to preserve impedance match. If this cannot be done, change the output transformer of the amplifier for one that will match your speaker arrangement.

New Forest 'Twin 50' for Two Arcs and Spot

A new type copper-oxide rectifier, known as the Twin 50, has been introduced by Forest Manufacturing Corp. It is really a double rectifier in one housing. It uses two separate banks of copper-oxide rectifying units, each having a capacity of from 30 to 50 amperes, designed to supply two projectors.

With one projector running, there is no reduction in current on this arc when the second arc is struck, as both rectifier elements are separate. One blower system is used for both rectifying elements. Automatic means are provided to protect the rectifier from any damage that might be caused by blower failure or short-circuit.

Individual Arc Adjustment

Means are provided therein for adjusting the output voltage and current individually to each arc, so that the rectifier may be used for Suprex trims of either 30-35 amperes, or 40-50 amperes. Line taps are also provided to take care of line voltages from 200 to 245 volts. This rectifier is designed for use only on three-phase A. C. supply, all three-phases being rectified and thus giving a smooth output.

For theatres using a spotlight requiring 50-55 volts at from 30 to 60 amperes, there is provided an attachment for the spot supply. Thus the Forest Twin 50 is a universal rectifier able to supply both Suprex projectors and a spot, a distinct advantage for theatres which, installing Suprex projection, heretofore had to provide other means for spotlamp supply, because of the higher voltage required.

S. M. P. E. Spring Convention at Roosevelt Hotel, Hollywood, Calif., May 20-24, inclusive.

The essential conditions for producing pictures in stereoscopic relief are two: first, separate pictures must be made from different points of view, corresponding to the two eyes; second, each eye of the observer must receive its appropriate view. No compromise with these fundamentals appears possible.

DR. HERBERT E. IVES
Bell Telephone Laboratories

THREE-DIMENSIONAL MOVIES 'RE-INVENTED' BY LUMIERE

RIGHT behind "television just around the corner" as a prolific source of hokum, buncombe or what have you is the topic of three-dimensional motion pictures. Driven to cover by the salvo of facts turned on them by the relatively few people who know something about television, the purveyors of hooey anent this baby art are timidly emerging from their hiding places and are once more giving three-dimensional pictures a whirl.

Of course, these merchants of mush find it convenient—nay, necessary—to forget the technical progress of the motion picture art to date, and they dismiss contemptuously the laborious research work of men like Drs. Ives and Kanolt, if in fact they ever heard of them.

And so it is that the technical press is once more wasting pounds of ink to saturate its pages with stories and photos of the "latest scientific miracle"—three-dimensional motion pictures.

During the week ending March 17 (may Erin's patron saint forgive them) practically every daily newspaper in the world carried a story which stated briefly that the venerable Louis Lumiere, after years of work in his Paris laboratories, had "solved" the problem of motion pictures in relief.

What matter it to editors, working feverishly to make a final edition, that details were lacking. Isn't Lumiere a name to conjure with in motion picture circles? Certainly. Anyhow, it concerned motion pictures, so let it ride!

Thus, the linotypes clicked, the stereos hissed, and the presses roared, and a vast reading public possessing incredible digestive tracts soaked in the news that three-dimensional motion pictures were a fact. Of course, it might be all of three weeks before this latest cinema marvel was exposed to view at the Garden Theatre around the corner. but one could wait. What clever devils these motion picture technicians be.

But, alas and alack, neither Louis B. Mayer, nor the eminent Irving Thalberg, nor Joe Schenck nor anybody within the majestic circle of Hollywood celluloid conveyors (we nearly said purveyors) batted an eyelash. Nor did the good Drs. Ives and Kanolt rush madly to the cable office. Why even the Academy forgot to issue a publicity release—and maybe you don't think that's something.

Such conduct was reprehensible. Something must be done. Something was done. The publicity pluggers promptly shifted their fire to the semi-technical and fan magazines and thus unveiled their fantasies, this time in greater detail, before another few millions of readers. Some yarn, to be sure—except that it was almost entirely boloney.

Details of 'Re-Invention'

An outstanding example of misguided journalistic fervor in this respect was on view in the science section of the *New York Times* for Sunday, March 17. Nicely packed around a 3-column halftone of the august Lumiere and his projection contrivance was the enthralling story of how he "solved" the problem of three-dimensional motion pictures. In 2,500 words, more or less, the *Times* technical editor disclosed to a palpitating audience of scientific neophytes the real low-down on this topic.

Consider these choice "revelations" of the Lumiere process as reported in the newspaper with all the news fitted to print:

" . . . As might be supposed, anaglyphic movies were experimentally produced in both Europe and America. Red and green pictures were projected. With red and green spectacles (obligingly provided by the management) you saw what seemed to be a black-and-white picture in sculptural relief. . . .

"The brightest rays are the yellowish-green in the middle of the spectrum. At opposite ends of the spectrum lie the dull red and violet rays. Lumiere divides the spectrum in two, straight through the portion of maximum intensity. Left-eye pictures are made by all the rays that lie to the left of the dividing line, and right-eye pictures by the rays that lie to the right. The luminous intensity thus is equally distributed between the two eyes.

"It follows that each eye sees not a pure color, but a mixture of colors running from yellowish-green to red on the one hand, and from yellowish-green to violet on the other. The problem presented is one for the dye chemist rather than for the mechanical inventor. But Lumiere knows his chemistry as well as his mechanics.

"To separate the two sets of colored pictures, spectacles are worn which are coated with gelatine suitably tinted. The left eye looks through gelatine dyed with a complex mixture of napthol green, eosin (red) and tartrazin—which transmits only the rays that lie in the yellow-green-orange portion of the spectrum.

"The right eye looks through a double gelatine coating. One gelatine is stained with a cyanol blue and the other with a sacchrine solution of diethylmetamidophenol. The rays that pass through are complementary to those seen by the right eye.

"Will the public wear spectacles merely to see favorite actors in sculptural solidity? . . . "

The answer to the last line is a positive no; and a hell of a lot of people can't see them at all.

From all of which we gather that Lumiere knows his chemistry as well as his mechanics—and about a million others know it equally well, at least well enough to have long since abandoned the idea of using analyzers to solve the problem of motion pictures in relief.

We also gather that that which Lumiere has "invented" is that which has been known in the art for more

(*Continued on page* 30)

Erpi Presses Service Plan; Attempts to Minimize and Misrepresents Craft Opposition

James J. Finn

DEVELOPMENTS during the month in the fight being waged by organized projectionists against the electrics, and in particular Erpi, in their attempts to take over the physical operation of theatres from roof to cellar, centered on an effort by Erpi to minimize the extent of craft opposition to the extended servicing plan.

Thoroughly startled by the formidable opposition to the plan mustered by Labor, supply dealers and manufacturers, plus the necessity for keeping a wary eye on the impending Federal investigation of sound picture companies, Erpi apparently experienced a trying thirty days.

The organized craft has come to understand that it has nothing to fear from extended servicing operations on the part of RCA, this company's position of having been forced to follow Erpi's lead in the matter and its announced intention of abandoning the plan should intense craft opposition develop thereto, being very well understood throughout the field. The battle from now on apparently will center on Erpi.

Chief among the month's developments was the vain attempt of Erpi to convey the impression that there is no "operator" opposition to their new service plans. Erpi representatives are known to have feverishly sought, and finally obtained, a conference with I. A. officials, during which Erpi's plans were discussed at length. It is understood that the conference was unproductive of any assurance by the I. A. that Erpi's plans would be permitted to go through as desired by the latter.

Misleading Press Releases

Almost immediately following this conference, however, Erpi caused to be published in a daily trade paper the statement that there had been no "official operator" protest and that "operators" (as Erpi termed them) were in fact in favor of the extended servicing plan. The statement went on to say that no major circuit other than Warner Brothers had dropped Erpi servicing since Jan. 1 last.

Prompt refutation of this statement by INTERNATIONAL PROJECTIONIST was ignored by the paper in question and by Erpi. Scores of letters in the possession of I. P., plus the lack of any statement from the Labor headquarters in support of Erpi's assertion, reveal that craft sentiment is directly opposite that which Erpi asserted it to be.

Also, I. P. cited the recent action of Loew's Theatres in dropping Erpi servicing in 63 New York City theatres; but this citation was also ignored.

This publication has received a report that only recently the Dallas Interstate Circuit, comprising 60-odd theatres in Texas, has paid off its Erpi obligations in full, cancelled its Erpi servicing contracts and embarked upon a servicing program of its own. RCA will continue to service the Photophone-equipped theatres in this circuit.

This report ties in with the statement made in these columns last month that several large theatre circuits—including Dallas Interstate, Balaban and Katz (Chicago) and Fox West Coast—had recently contracted with independent manufacturers for tubes, cells, etc., which otherwise would be supplied under the well-known Erpi R. & R. contract.

Reports from the field to I. P. indicate that Erpi field men, in sharp contrast to their feverish activity of some weeks ago in surveying theatres, have dropped this work and are now doing only routine servicing work. Many units of the organized craft report that Erpi field men

More Erpi Servicing Propaganda

Reprinted from *Motion Picture Daily* for April 10

Erpi to Reach Decision Soon on Servicing

Erpi's experiments in connection with the servicing of all phases of theatre engineering are expected to be concluded within the next 60 days, at which time a final decision will be made on Erpi's entrance into the extended servicing field on a permanent basis, it was stated yesterday . . .

It was again stated that if a decision is made to make the extended servicing a permanent adjunct of Erpi's activities, no merchandising of parts or equipment other than that having to do with sound reproduction, is contemplated. Contrary to reports, it was stated that operators' locals not only have made no official protest to the contemplated servicing by Erpi engineers but, in situations where the current experiments are being conducted, have regarded the new service as an aid to operators and favored its continuance, it was said . . .

The new contracts offer either 12, 17 or 26 service calls per year, with correspondingly reduced charges for the lesser number of calls. The old contracts were for 26 calls exclusively, except for the special 52-call contracts made with large de-luxe houses, which are still being offered. The new contracts are being made for one, two and three-year periods.

Competitive Servicing Bids

With the simultaneous expiration of a large number of service contracts in the Detroit area recently, Erpi was faced with competitive servicing bids made to the local theatres by Allied of Michigan, the Allied States exhibitors' unit headed by H. M. Richey, and the Detroit operators' local. New contracts were closed recently, however, between Erpi and the Paramount-Trendle theatres and the Butterfield circuit. Paramount theatre operating partners nationally are also in the process of closing new servicing agreements with Erpi. Since the first of the year the only large theatre group not to renew has been Warners, which developed its own service department.

have sought to win Union favor against the time Erpi might be forced to cease servicing operations in the theatre field.

Erpi's Statement Refuted

In answer to Erpi's statement that there has been no "official" organization protest to their projected servicing plans, there accompanies this article an exact reproduction of the front page of the current I. A. Official Bulletin. This reproduction, in company with the direct quotations by International President George E. Browne and the decision of the I. A. General Executive Board on this topic as published in these columns, leave no doubt as to the "official" stand of the I. A. on the servicing question.

By way of contrast there is also reprinted along with this article a major portion of the trade paper story previously referred to which sought to soft-pedal "operator" opposition to the Erpi servicing plan. The story is reproduced not because I. P. has any belief in its content but merely as an interesting publishing curio and by way of contrast with existing facts.

Significantly enough, however, the story contradicts itself by first citing no "operator" opposition and then stating that Erpi was faced with "competitive servicing bids" by, among others, the Detroit "operators'" local. This action by the Detroit local definitely bespeaks opposition to Erpi servicing and accurately reflects the attitude of I. A. units everywhere. Thus, Erpi seems to be the best witness against itself.

Erpi's latest servicing advertisement pictures the Erpi exhibit at the recent New Orleans exhibitor convention, which included a complete Erpi theatre sound installation gaily bedecked with scores of colored ribbons indicating possible trouble sources. Evidently intended as a boost for Erpi servicing, both the exhibit and the advertisement were thought by many to convey the impression that with so very many possible sources of trouble, the Erpi equipment was so intricate and in need of such constant attention as to give pause to any potential purchaser thereof.

I. P. has learned from a usually reliable source that Erpi, prior to the launching of the stiff battle against its servicing plans, had every intention of completing its domination of the theatre equipment and servicing field by either developing or acquiring a national distributing organization. Existing distributing facilities appear to be beyond the reach of Erpi at present, according to emphatic denials issued by the heads of both existing national set-ups.

The original plan, according to I. P.'s information, was to go out and obtain about 3,000 or more all-inclusive theatre servicing contracts, after which Erpi's announced intention of confining itself merely to "recommendations" of equipment purchase very easily could have been transformed into the actual writing of an equipment order to itself.

Recurrent rumors of Erpi's entrance into the projection equipment manufacturing and distributing business appear to have no basis in fact in view of the meager progress made by Erpi with its latest servicing plan. I. P.'s informant insists, however, that Erpi still contemplates just such a move.

Servicing Field Activities

Of particular interest to projectionists' unions is the following communication received from one of the many representatives who are constantly checking on the activities of field service men and reporting to I. P.:

> ". . . The local . . . officials had a conference here the other day in which it was decided that in the event they should lose the service work, they will close up their warehouse and carry no stock whatever . . .
>
> "They would then force the others (those doing the servicing) to wait from two to three months for parts. I was told that they did not include the Local Union in this ban—that is, if the Local did the servicing it would be able to obtain the parts. However, this was not specifically so stated during the conference, thus it still is a matter for conjecture as to just what attitude . . . would take on parts sales to the Local.
>
> "All my information points to . . . not being willing to deal with the Local, and I personally believe strongly that they will pull the delay business on the Union as well as on the others.
>
> "One specific point should greatly interest I. P. readers. It is that . . . will supply parts to former service men as quickly as they are needed. *The conference was most specific on this point.* If one reads between the lines, one will readily see that . . . will do all in its power to see that ex . . . men get the work, and they will not willingly let the Local or anyone else have it . . ."

Confirmation of the electrics' attitude toward Local Union servicing is contained in a second communication received from a representative in another section:

> " . . . The sound service man here has insisted frequently of late that there is absolutely nothing to the idea of Union sound servicing, because the Union will not get the needed parts. I reminded this party that, although I didn't believe . . . would be so foolish as to adopt any such scheme, it still

In Answer to Erpi's Claim of No 'Official' Craft Opposition

General Bulletin No. 294	Issued from the General Offices of the INTERNATIONAL ALLIANCE OF THEATRICAL STAGE EMPLOYES AND MOVING PICTURE MACHINE OPERATORS OF THE UNITED STATES AND CANADA Suite 2008, 1450 Broadway, New York, N. Y.	Thursday, March 21, 1935

Officers—GEORGE E. BROWNE, President; FRED J. DEMPSEY, General Secretary-Treasurer JOHN P. NICK, First Vice-President, 4 South Eighth St., St. Louis, Mo.; WILLIAM P. COVERT, Second Vice-President, 257 Brock Ave., Toronto, Ontario, Canada; HARLAND HOLMDEN Third Vice-President, 19454 North Sagamore Road, Fairview Village, Cleveland, Ohio; RICHARD F. WALSH, Fourth Vice-President, 554 Atlantic Ave., Brooklyn, N. Y.; FLOYD M. BILLINGSLEY, Fifth Vice-President, 340 Valdez Ave., San Francisco, Calif.; JAMES J. BRENNAN, Sixth Vice-President, 254 West 54th St., New York City, N. Y.; ROGER M. KENNEDY, Seventh Vice-President, 1002 Hofman Building, Detroit, Mich. Trustees, R. E. MORRIS, GEORGE W. BRAYFIELD, WILLIAM SCANLAN.

IMPORTANT NOTICE—This Bulletin must be read at the next special or regular meeting of your local union and permanently filed with its records. 44

Spike Servicing Grab by Flat Refusal to Relinquish Any Portion of Jurisdiction

Where there's smoke, there's fire, and with the vast billows enshrouding the "Servicing Issue," this doubtless amounts to more than just a glowing ember. Quite possibly it's the fumes emanating from the dense smoke screen laid down by the various sound companies to camouflage their future movements, as pointed inquiries have met with terse denials or subtle evasions, which in no way has served to clear the heavy cloud of suspicion annexing itself to this question so vitally important to our interests.

The entire matter was thoroughly aired at the last meeting of the General Executive Board. Realizing the deleterious effect of private enterprise making inroads on our present jurisdictional possessions, the Board naturally was more than emphatic in its recommendation to our local organizations—"to maintain this work without qualification."

Reading between the lines of the contemplated move, it is clearly perceptible that this condition would by no manner of means be confined solely to the precincts of the booth and its complementary equipment, but would eventually be amplified to include the stage and its fixtures.

If these outfits are permitted to wedge their way, even to a minor degree, into our properly constituted jurisdiction, just how far they will go isn't even a matter of conjecture. Nor have we any intention of starting a guessing contest to measure the limits of their untimorous capabilities by granting them such an opportunity. We can definitely answer the challenge of testing their limitations by an absolute refusal to furnish the all necessary encouragement of a foothold to try their success at usurping our jurisdiction.

The claim of our Alliance to this particular class of work is no after-thought or sudden desire that has sprung up to expand by a jurisdictional encroachment. Many of our projectionist members are sound pioneers, having made an exhaustive study of it since its inception. As time went on they kept pace, step by step, with the ever-changing phases corresponding to the progress and advancement made.

With some effort we were successful in securing conditions in keeping with the service performed. Now we are faced with the dire necessity of maintaining tbis work, and to whicb end the General Office insists that any and all projection room and stage servicing work is to be done only by the members of our Alliance.

To cope with this judgment, local organizations are summoned and petitioned to familiarize tbeir membership with every aspect of servicing. The damaging consequence failure to observe such a recommendation would have on all Locals of the International cannot be even roughly estimated.

Judging from the nature of tbe correspondence being received at the General Office, relevant to this subject, obviously several of these sound companies are busily engaged in making surveys preparatory to furthering their servicing plans. Reports to such effect are not coming in from any one particular section, but are despatched from every corner of the country.

Each Local Union of the Alliance is requested to keep the General Office posted as to any developments along these lines. Also keep us informed of developments of an unusual or suspicious character. If an attempt is made to inaugurate a policy along the lines depicted, it should be instantly brought to the attention of the General Office and immediate steps will be taken to rectify sucb condition.

To he fore-warned is to be fore-armed, so there is absolutely no reason for any of our local organizations being caught with their guards down and chins protruding, inviting a lethal blow from this source. Regrets bave never yet made a suitable substitute for the winners' end, but instead of trying to prove the wisdom or fallacy of such contention, let's be on our toes and avoid the necessity of any belated lamentations.

wasn't necessary for a theatre to have . . . equipment in order to operate.

"At present the owner is considering revamping our sound equipment to allow extended range reproduction, but I have practically unsold him on this idea in favor of another make of sound equipment . . . Maybe this trick repeated in a few other places will cause . . . to change its mind about Unions servicing."

The foregoing reports anent the propaganda being spread in the field relative to Union servicing of sound equipment is very interesting, but few Locals appear to be concerned and hold to the view expressed by the second letter above. Should a given theatre discontinue sound servicing, and many of them are, the sound company would hold only a lease contract calling for payment of $1 a year and would have absolutely nothing to say relative to replacement parts. The effort to place theatre sound systems in the same class with telephones, attachments to which are prohibited, likely would meet with little success.

Parts Supply Assured

Further, there are today many sources of supply for all sound system parts, and the list of such manufacturers would be increased greatly once it became known that difficulties were interposed in the way of obtaining parts. History records no instance of where a commercial enterprise deliberately ignored a lucrative parts business.

In any event, should Erpi, for example, adopt such tactics on parts sales, the matter would undoubtedly be made the basis for an interesting legal action the outcome of which, win or lose, would hardly tend to build up good will for either Erpi or its parent company, the American Telephone & Telegraph Co. The latter forbids the attachment to telephones of other than approved parts on the ground that service may be disrupted. One finds it hard to match this policy with one where the refusal to supply parts for a given equipment would directly contribute to suspension of service.

Considering all this, it might be well for projectionists to advocate strongly to owners and managers the purchase of other sound equipments which are sold outright and carry no lease clauses which enable the seller to collect thousands of dollars and still retain ownership of the equipment.

Advices from the field tend to confirm still another statement made herein, as follows:

> " . . . This new servicing plan is merely the last-ditch fight of the electrics to retain their identities as a . . . servicing organization, with its (to date) lucrative pickings—straight equipment sales today beng mostly replacement jobs."

Field reports indicate that sound company warehouses are stuffed full of equipments that were never sold and those that were pulled out of theatres for one reason or another. Sound system business today is strictly a replacement business, and in this direction RCA has been particularly successful.

This being so, it is a question as to just how long any parent company will continue to favor the existence of a subsidiary which shows nothing in the way of income to warrant its continuance. Neither RCA nor A. T. & T. will long continue a subsidiary which fails to justify its existence on a purely business basis. Hence, the view of I. P. that the sound companies must of necessity insure their continuance by rigging up a more or less guaranteed income from extended servicing operations. Failing to do so, they will cease to exist.

Erpi's abortive attempt to gain organization approval for its servicing activities served to focus attention upon the servicing plans of the International Alliance, which thus far has been working behind the scenes and making no announcements other than those appearing in its Official Bulletin and in these pages.

Direct I. A. Contact Asked

It is expected that the International Alliance, upon completion of a nationwide survey now in progress, will immediately acquaint its affiliated units with its official attitude toward servicing activities.

International Projectionist has been asked by the I. A. to publish a request that all Local Union communications relative to any phase of theatre servicing work be addressed to the General Office of the I. A. in Washington, D. C. Adherence to this procedure will enable a more rapid collating of servicing data.

Elsewhere in this issue I. P. asks editorially that, in view of the widely divergent policies of RCA and Erpi on theatre servicing work, and because of other important considerations, projectionists exert every influence in favor of RCA or other sound equipment manufacturers. The editorial cites the records of both companies to date and states that the RCA policy is by far the more favorable to the interests of the organized craft. In addition, it continues, RCA equipment justifies this support on the part of the craft.

One splendid result of the servicing drive to date has been the reawakening of craft interest in educational activities. Cities, counties and in one instance a State, report the formation of educational societies. Even should the craft fail in its major objective of controlling servicing work, its efforts have at least resulted in immeasurable good through the resumption of educational activities.

Strictly technical questions relating to servicing operations may be directed to I. P. as in the past. Communications relating to servicing activities by organizations as such should, in conformance with the expressed wish of the I. A., be sent to the General Office in Washington, D. C.

Servicing Developments At a Glance

Erpi denies organization resistance and claims craft approval for servicing plan. I. P. proof to the contrary is ignored.

Rumors of Erpi participation in manufacturing and distributing field persist.

Large theatre chain in Texas reported dropping Erpi service, following lead of Warners and Loew's. Independent manufacturers write large sound parts contracts.

I. A. engaged in nation-wide survey of sound system servicing situation.

Projectionists are advised by I. P. to favor RCA or other sound reproducing equipment manufacturers as a means of forcing recognition of craft's jurisdictional rights.

Field service men spread word that Locals will experience great difficulty in obtaining replacement parts. Ample supply from independents is assured.

I. A. units requested to direct communications relating to organization servicing activities to General Office in Washington, D. C.

Duovac vs. Erpi Sound Suit Enters Second Phase

Another chapter in the court history of Duovac Radio Tube Corp. against Erpi, Western Electric and A. T. & T., parent body of both electric companies, is being compiled as these lines are written. Beginning on April 22, Duovac is pressing ahead for a permanent order affecting a temporary injunction already granted it in its fight against Erpi and W. E. on the latter's alleged monopolistic activities in restrain of trade in the sound motion picture field.

Triple damages will accrue to Duovac if success attends its efforts in the case, which is expected to require two weeks to be heard. Previous court sessions in this noted industry legal joust resulted in the Erpi sound equipment contract being declared illegal, following which Warner Bros., co-plaintiff with Duovac and General Talking Picture Corp. (De Forest), settled its claim for $3,000,000.

LOCAL 52 ANNUAL BALL

Motion Picture Studios Mechanics Local 52 will sponsor an entertainment and ball for its benefit fund on May 17 in the grand ballroom of the Delano Hotel, 108 West 43rd St., New York. Sol Scoppa is chairman of the arrangements committee. Many stars of the stage, screen and radio will appear.

The IP EDITORIAL PAGE

Vol. 8, No. 4 APRIL 1935

Craft Action Necessary On Servicing

Enough words have been spread over these columns to acquaint industry workers with the grave dangers inherent in the threatened extension of the electrics' influence in the theatre field. We are not ordering the destinies of the craft, being content merely to point the way and let the craft choose that course which will best bring it home safely. As long as INTERNATIONAL PROJECTIONIST is published, however, it will offer vigorous opposition to any schemes which aim at domination of the exhibition field, whether fostered by the electrics or any other group. This is sound business practice, viewed even at its worst.

We emphasize anew that which was stated herein several months ago: that throughout this clash of interests over servicing work RCA has done nothing which could be regarded as detrimental to the welfare of projectionists. RCA has been strictly on the up-and-up, has dealt the cards above the table, has come forward with a frank and detailed statement of its position, has offered guarantees of non-interference with craft interests, and overall has acted like the business-like organization that it is.

Also, as previously stated, RCA has given this industry its money's worth in the way of good equipment, a liberal sales policy which included outright sale and no compulsory servicing, and has ever been first to bring its equipment in line with approved modern practice.

Erpi's attitude and actions, on the other hand, have been in sharp contrast to the RCA policy. Erpi has ducked and dodged around every corner that offered even momentary protection from the winds of projectionist ire (as long as it didn't have to face the issue today, you know); it has handed out large doses of silence in response to repeated direct requests for details of its plans; it has—worst of all—permitted itself to be quoted as the source of misleading statements, and it has conducted itself overall in such a manner as to occasion grave doubts as to its sincerity in dealing with the craft.

Now, it is not enough to merely cite this record and let it go at that. The situation demands action. For this and other reasons which may be held in reserve for some future date, INTERNATIONAL PROJECTIONIST now advises projectionists, whenever and however possible, to favor RCA equipment. This advice, let it be said, is in line with Labor's traditional policy of rewarding its friends.

To be more explicit: until such time as Erpi's servicing plans are so clarified as to be acceptable to the craft at large, we urge that projectionists exert every influence they can possibly muster and employ every means at their command to favor RCA or any other sound equipment manufacturer whose product they may wish to use. Undoubtedly such action will better acquaint Erpi with the temper of the craft.

Through the industry trade press, which will print almost anything, Erpi has sought to convey the impression that the organized craft is not opposed to, but actually favors, extension of its servicing influence. To one and all, including Erpi, we declare that *this statement is positively untrue.*

It is quite true, of course, that a couple of Erpi brass hats hurried West and camped on the doorstep of an organization leader, probably to counteract the influence of that dreadful Finn person. After filling the air for quite a spell with some rather aimless verbiage that never even remotely approached solid fact, these Erpi satellites carried away the impression that everything was hunky-dory along the Labor front. Subsequently they issued a trade paper statement that not only was there no "official" operator protest but, indeed, the operators favored the new Erpi servicing plan.

Now, whether the Erpi brass hats visited San Francisco, Chicago, Atlanta or even Hong Kong, the fact remains that the organized craft is not only opposed to any extension of Erpi's servicing activities but actually opposes the continuation of even their present somewhat restricted (through organization pressure) servicing operations. Erpi can issue statements from now until October, but it is understood very well that INTERNATIONAL PROJECTIONIST is better qualified than Erpi to interpret the attitude of the organized craft.

We stand ready to accommodate Erpi or anybody else who desires to test the accuracy of the foregoing statement. And they needn't waste time running to organization headquarters for a denial, either.

INTERNATIONAL PROJECTIONIST is not unaware of the effect upon Erpi and others of its campaign against them to date. Craft sentiment throughout the country has been so effectively marshalled against the electrics' servicing plans that scores of busybody service men in various territories have ceased abruptly their survey work and, instead, have dogged the footsteps of organization leaders to find out where they stand should Erpi eventually be moved out of the servicing field. Erpi was never prepared for the storm of anger and protest which hit it from all sides.

We are firmly convinced that Erpi's particular plan is of long-range significance in that it embraces something more than merely general theatre servicing. We can see where within a short time after a raft of such contracts are written the industry might wake up some morning to find Erpi actively embarked on a program of manufacturing and distribution of all units of theatre equipment. In fact, we have had several reliable reports that this is precisely what Erpi plans to do. Need we emphasize the danger to the craft, and to the theatre field generally, of any such set-up?

And thus we come by a somewhat circuitous route to the pressing question: What is to be done about it? The first thing to be done, as previously stated, is to fight back against Erpi with those weapons immediately available by exerting every possible influence on sound equipment sales, service and parts contracts, and in the all-important matter of general good will. The results of such a campaign by the thousands of projectionists scattered throughout the country should be devastating. Reward your friends!

The next step by every organization is to PREPARE to take over servicing work. This is something that can not be done overnight but requires careful preparation and planning, the assembling of the necessary tools, parts and other equipment, and insurance against any possible shortcomings in the type of service rendered. Private advices by this publication have outlined these requirements in detail. Once prepared, *and only then,* give your enemies both barrels.

But most important of all, and while active preparation

(Continued on next page)

is in progress, there must be carried on a campaign of such force that not only Erpi but all others will have unmistakable evidence of the craft's power to defend its hard-earned rights in this field. Explicit instructions as to what form such a campaign should take are, we think, wholly unnecessary.

This much being done, we are certain that Erpi will have changed its opinion that it can come into this field and operate as it pleases. This is not 1927.

'Expert' Two-Men Projection Shift Advice

The motion picture trade press has the lowest standing of any group in the entire publishing field, what with the existence of "guaranteed yearly minimum advertising" contracts and constant pandering to producer-distributor personages of much unimportance. But the trade press is funniest when, in a desperate attempt to placate such projectionist circulation as it has, it must straddle the issue of two-men projection shifts. Of course, this topic is now only of academic interest, as a result of carelessness and stupidity on the part of the craft at large. Yet, the subject still retains its old-time power to terrify the trade press writers. We offer to those "expert" technical writers the following gratuitous advice:

1. Projection room manpower is wholly unrelated to theatre seating capacity. A picture show in the Radio City Music Hall in N. Y. City employs the same kind and amount of equipment (one projector at a time, with two projectors in the room) as that used for the same purpose in a 400-seat "shooting gallery" on Sheridan Road in Chicago; and
2. Admission price has no relation to projection room manpower requisites, speaking from the strictly technical angle, of course.

This much having been said, the "experts" can figure out their duties to their projectionist subscribers, if any, in any fashion they choose.

Corrective Action on Print Footage by S. M. P. E. and M. P. P. D. A.

ESTIMATING the running time of a given film program is a task which occasions not a little trouble, particularly in subsequent-run theatres. Of interest to projectionists who weekly, or more often, are forced to engage in this "guessing contest" is the following communication:

Editor, International Projectionist.

Sir: Many projectionists—especially those in the subsequent-run theatres—are often called upon to estimate the running time of a show. Sometimes the guess is close enough to avoid difficulty, and sometimes—well, the show is maladjusted in one way or another.

This guesswork results in no little confusion, the projectionist has to work late, do unnecessary cutting, rearranging and a lot of other juggling. Although the projectionist is not held directly responsible for these errors, it seems to me to in some way hurt his prestige, even though he may guess right more often than wrong.

I would suggest, therefore, that every projectionist, after running the show and when ready to ship, mark on the bands of the reels the correct running time of features, news, shorts, etc. If a majority of the fellows adhere to this practice it should be only a short time before shows come through with correct running time marked thereon.

Maybe the proper procedure would be to appeal to the exchanges; but our experience with exchanges to date on similar matters arouses small hope that any action would result.

Max Bentzman
Springfield, Mass.

S. M. P. E. Action Requested

Several letters citing the need for such action having been received by I. P., the matter was brought to the attention of the Motion Picture Producers and Distributors of America, which in turn promised every cooperation and enclosed a copy of a letter to the chairman of the Exchange Practice Committee of the S. M. P. E., excerpts from which follow:

. . . It is realized that most press sheets give the running time of features, and there are some magazines which give this information in their reviews; but it is seldom that press sheets or such magazines reach the projection room.

Also, there may have been eliminations in the film either because of censorship or damaged parts, which would change the footage . . .

The suggestion has been made that after inspection of each print in the exchange, the footage be marked on the reel band for both features and shorts. The projectionist can then, by a simple mathematical process, figure the exact running time of the show. This would be most helpful to the subsequent-run theatres or those . . . situated in small communities.

Will you give this your consideration . . . at your next Committee meeting?

A. S. Dickinson

While censorship might affect materially the footage figures as published in various exhibitor trade papers, this would not be a problem once a state board passed a given picture, because in a great majority of cases all prints thereof would circulate within the borders of one state. Excessive projection room cuts are not so noticeable since the advent of sound pictures, even though careless handling apparently has failed to reduce other abuses.

Several readers of I. P. have suggested publication in these columns of film footages; and failing such action by the exchanges as would satisfactorily solve the problem, I. P. is prepared to do just this. Comments from readers anent the desirability of such a service is invited.

To the Benefit of the Art and the Craft

DEPARTING from a heretofore inviolate rule that its editorial columns shall contain no direct reference to products advertised in its pages, International Projectionist specifically directs the attention of its readers to the advertisement of the International Projector Corp. on the fourth cover of this issue.

Here is an advertisement which, crowning a series of similar splendid gestures by this company, is concerned entirely with selling the idea of better craftsmanship, better equipment and, as a result thereof, better projection—to the exclusion of even a mere mention of the company's products.

Intelligent and far-seeing promotional work of this character, which can not fail to reflect credit upon the art and craft of projection, to the ultimate benefit of both, certainly is deserving of evoking a tradition-shattering editorial mention of this character.

We salute the International Projector Corp. as a fine influence upon better craftsmanship.

The Editor.

NEW PORTABLE P. A. SYSTEM FROM RCA VICTOR

A new portable public address and sound reenforcement system for moderate sized public places, compactly self-contained in a carrying-case and weighing only 28½ pounds has been introduced by RCA Victor.

This unusually adaptable unit, which anyone can put into operation in less than a minute, is particularly suited to the steadily growing market for an inexpensive, though efficient, portable sound system for such applications as window demonstrations in dealers' stores, counter-to-kitchen restaurant call systems, and for local fairs and carnivals.

Exceptional tone quality and simplicity of operation distinguish this low-cost system. It is only necessary to connect the power plug to the 110-volt, 50-60 cycle house current supply, and plug in the microphone and speaker cables to set the system in operation.

BACKGROUND PROJECTION FOR PROCESS CINEMATOGRAPHY

G. G. Popovici

Generally regarded as the tail end of the motion picture process, projection has been playing an increasingly important role in the studios through the development of the 'process shot', as background projection is known. That intriguing background seen in any number of current productions means not that the production unit travelled afar on a location trip but that the industry's technical workers have registered an important advance and projection has made another outstanding contribution to the progress of the art. The why, how and what of this extremely interesting process, as originally presented before the S. M. P. E., is set forth in the accompanying article.—Editor.

BACKGROUND projection for process photography now used extensively in all motion picture studios is more economical than the Dunning process, the color-separation method, the use of printing masks, and other arrangements. It is probably the simplest process that has yet been devised, and with proper care can produce satisfactory results.

It consists in projecting a picture of the desired background, which has been photographed previously, upon a translucent screen, the foreground action of the picture taking place in front of the screen. The foreground objects are so lighted as to balance the screen illumination, and the whole is finally photographed as a composite scene.

The most important factor involved in the background projection process is steadiness of the picture. To begin with, the negative film used for making the "plate" or "key", which are the names given to the scene to be projected, has to be very accurately perforated, and only fresh stock must be used. Eastman and Du Pont have both developed such an accurately perforated film, having a finer grain with a slightly lighter contrast than the regular negative emulsions, and having approximately the same camera characteristics as the regular Super-Sensitive Panchromatic negative.

The camera used for shooting the plates must produce absolutely steady pictures. Its ability to do so depends upon the mechanism of the camera itself and the manner in which the camera operates. A standard Mitchell camera having a shutter opening of 170 degrees is used for making the plates, and its steadiness is carefully checked periodically to assure good results.

The prints to be projected present a problem that has not as yet been solved satisfactorily. Due to pilot-pin registration in step printing, shrinkage of the developed negative causes some difficulty. If the pin is designed for the sprocket-hole of fresh positive stock, using the Bell & Howell perforation, during printing the negative sprocket-hole will be forced down upon the pin by a slight movement of the finished positive due to shrinkage.

No matter how the pin is designed, so long as shrinkage is to be considered some difficulty will always exist. Only unshrinkable stock would be completely satisfactory for pilot-pin registration.

Projection of the plate positive has successfully been accomplished in our studios. Contrary to West Coast procedure, we use a side-guided projector, designed by the International Projector Corp. To assure perfect steadiness, the gate and film-trap have been especially designed. The steel guide is hard and has been ground. The tension springs are carefully balanced to assure perfect side-guiding and proper gate pressure. The Geneva intermittent movement is selected for its precision, having no tolerances, and the intermittent sprocket is of the type recently approved by the S. M. P. E. and has also no tolerances.

An ingenious device incorporated in this projector enables the projectionist to check at any time the steadiness of the projected picture. Unsteady projection may be attributed to the print or to the projector. To be able to check one or the other at once, a cut-out is provided in the gate permitting an image of the edge of the running film and two sprocket holes to be projected upon the screen with the picture.

If the image of the sprocket holes is steady and the picture image is unsteady, the print is obviously the cause of the unsteadiness. If the sprocket hole is unsteady, there still remains the question whether the projector is working properly, because instances have been found in which the film had shrunk unevenly, causing the sprocket holes to be unsteady. Such a test should always be made with fresh stock. (It is of vital importance that the projector always be kept clean, because an accumulation of dirt may cause unsteadiness of the projected image.)

The advantages of this projector over those employing the claw movements are outstanding. This projector has a shut-

(*Continued on page* 26)

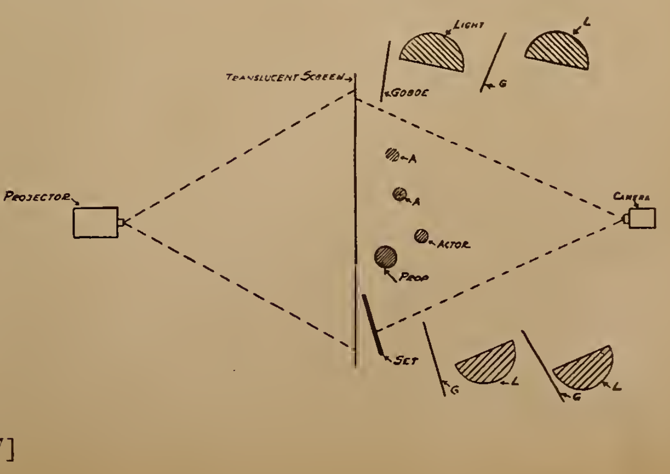

FIGURE 1

Set-up of projector, camera, translucent screen, lights and actors for rear projection process photography.

Mr. Hoffman Replies:

'COSTS — INITIAL AND OPERATING — FAVOR THE A. C. ARC'

Ernest Hoffman

HOFFMAN & SONS ELEC. ENG. CORP.

READERS of I. P. might have gathered from the article "A. C. vs. D. C. Suprex Arc Operation," which appeared in these columns last month, that I am opposed to the new D. C. arc. Mr. Finn's reply, directed specifically to me, may have lent color to this belief.

Such is not the case. I am not opposed to the new Suprex D. C. arc, as there is no question but that it delivers results comparable with any type of hi-low lamp and, in some instances, approximates the results obtained with the rotating high-intensity arc, thus showing considerable savings. Certainly the D. C. arc has a field—and a wide one.

I do maintain, however, that an A. C. arc, given a proper controller and suitable transformer, would fill the bill very well. The smaller theatres now using low-intensity lamps (and they certainly constitute a great majority of the projection field) could use the A. C. arc to great advantage, considering the savings made possible by its use.

I do not agree with Mr. Finn's analogy of the action of an arc and an incandescent lamp. Flicker is caused by the frequency of the supply circuit, and in support of this reference is made to the action of incandescent lamps on 25-cycle current in which the flicker is visible to the naked eye. This is not the case on 60-cycles, as I pointed out, and certainly this flicker is not visible in the A. C. arc because the gas ball, and *not* the crater, is the light source—although it is a fact that the crater is necessary to produce this gas ball.

Cites D. C. Arc Flicker

Shutter flicker we shall have with us until projector manufacturers find some means of eliminating it. This shutter flicker is evident with any light source; and I maintain that the more light thrown on the screen, the more visible becomes the flicker.

In proof of this, we found in an actual test that there was more flicker apparent on the screen with the D. C. arc than with the A. C. arc, solely because the former delivers more light to the screen and thus accentuates the flicker effect to the shutter.

Relative to conversion jobs, I fail to see where the addition to present equipment of a transformer and a controller makes junk of the installation. Neither do I feel, of course, that the conversion of present equipment which is in bad shape will make possible "Broadway projection." My contention is that the A. C. arc has a definite place in the projection field, particularly where costs are concerned.

Relative to the status of rectifiers, let us bear in mind that oscillograph curves used in an article by W. C. Kalb in these columns[1] disclose that the A. C. arc curves and the rectified curves for the D. C. arc are practically superimposable upon each other. This bears out my contention that if flicker be visible with the A. C. arc, this condition is aggravated with the D. C. arc which gives more light.

Mr. Finn appears to be suffering from a rectifier complex, so vigorously does he insist upon their efficiency. We all know that where rectifier tubes are in use on up to 3,000 hours, these cases are merely the exceptions that prove the rule. Were the efficient operating life of bulbs in excess of 1,000 hours, the manufacturers thereof would certainly raise the guarantee period.

As to copper-oxide rectifiers, my experience with the smaller sizes is that trouble did develop in the disks. With the increased current capacity required by the Suprex D. C. arc—45 amps. or more—this trouble will increase and replacement of units will be necessary, to what extent neither I nor anybody else now knows.

Strongly Favors Generators

All factors being granted careful consideration, motor generators should be favored for the Suprex D. C. arcs, where new installations are contemplated. Costs being a secondary consideration (as they must be in new jobs) I personally would favor generators over any type of rectifier.

I am very glad to accept the invitation to submit tables of costs bearing on (1) new equipment costs, and (2) operating costs. It will be noted that for a majority of theatres during these trying times many factors favor the use of the A. C. arc. A conversion job certainly is in order in all cases where a minimum capital expenditure is essential, provided, of course, that present equipment be in fair condition and an immediate return on the investment is desired.

Assuming that present equipment is replaced (as Mr. Finn recommends), the capital investment on the part of the theatre is set forth in Table A. It is apparent therefrom that, based on list prices, from $1100 to $1850 will have to be expended, depending upon the purchaser's choice.

This brings us to the really serious blow to the theatre—operating costs. I have prepared a chart, Table B, which sets forth very clearly the various operating costs—for Low-Intensity, for the new A. C. arc, and for the Suprex D. C. arc.

It will be noted that, quite apart from the installation expense, the operating costs range from $773.80 per year for

Table A
NEW INSTALLATION COSTS

2 Lamps ($300-450)	$600 to	900
2 Rheost. (28-37)	56 to	74
1 M. G. Set (aver.)	763 to	876
Total	1108	1568
WITH RECTIFIERS:		
2 Rect. ($200-280)*	$400 to	560
Bulbs (12) @ $9 ea.*	108 to	108
2 Lamps (as above)	600 to	900
Total	1108	1568

**Mr. Hoffman's original minimum rectifier figure of $160 is too low; while his bulb figure of $15 is too high.—Ed.*

[1] "Characteristics and Uses of the Carbon Arc," Vol. 7, No. 4, Oct., 1934, pp. 11-15.

the A. C. arc to $2222.85 for the Suprex D. C. arc where the present motor generator set is retained and used in an overloaded condition.

Conversion Costs

Harking back to installation costs consider the following conversion costs. The conversion of present lamps requiring two suitable transformers and two arc controllers represent a maximum cost of $500, as against its nearest competition (rectifiers and new lamps) at from $1100 to $1640 list. Moreover, the latter great expenditure would net no better results, as far as flicker is concerned (referring back to Mr. Kalb's oscillographs).

Furthermore, after the capital expenditure for new equipment was made, there still remains the comparative annual operating costs of $773.80 for the A. C. arc as against $1587.85 for the Suprex D. C. arc using rectifiers, a difference of $814.05 in favor of the A. C. arc.

The A. C. arc obviously is anathema to Mr. Finn, but even where results would be much worse than he admits are possible, the accompanying data make it impossible for me to accept his opinion as to (1) the acceptability of conversion jobs, and (2) the worth of the A. C. arc for small-theatre projection.

ARC DATA SUMMARY

James J. Finn

THE relative merits of the A. C. and the D. C. arcs having been discussed in detail in these columns last month, Mr. Hoffman requested, and was granted, the opportunity to present figures which, he asserted, would justify use of the A. C. arc on the basis of installation and operating costs. He presents these figures herein.

Mr. Hoffman evidently takes leave of his favorite topic, the A. C. arc, with considerable reluctance, being unable to resist the impulse to make a few more

(*Continued on page* 21)

ANOTHER OPPOSING VOTE ON L. I. LAMP CONVERSION

J. E. McAuley

J. E. McAULEY MANUFACTURING COMPANY

Appended hereto is the second contribution to the symposium sponsored by I. P. to determine the desirability, or lack of it, of converting existing low-intensity lamp equipment for use with Suprex carbons—a topic which continues to furnish the projection field with much lively discussion. Mr. J. E. McAuley is particularly fitted to discuss this interesting and very important topic by reason of his long experience as a designer and manufacturer of arc lamps which have been used for many years throughout the world.—Editor.

IT is with great satisfaction that I accept your kind invitation to present my views on the conversion of existing low-intensity lamps for use with Suprex carbons. In providing the forum for the presentation of all shades of opinion on this question, I. P. is performing a real service for manufacturers, projectionists and exhibitors.

The cubical contents of the L. I. lamphouse, as well as the ventilating stacks, are not of sufficient dimensions to carry off the smoke fumes generated by the Suprex type arc.

None of the L. I. lamps have means to protect the reflector from sooting up when the arc is being struck or while the carbons are being burned in.

Low-amperage lamps carry the arc so close to the reflector that excessive and costly mirror breakage inevitably results since the mirrors used for low-amperage arcs are not of heat-resisting glass.

The magnification of low-amperage lamp mirrors produces a proper size spot at the aperture when employing a 12 mm. positive carbon. When 7 mm. positive carbons, such as the Suprex, are used with this mirror, the crater magnification is not great enough to produce a spot that properly covers the aperture, hence very poor light distribution is had on the screen. The result is that the center of the screen is bright, whereas the light on either side of the screen center falls off tremendously.

The relatively small diameter of Suprex carbons necessitates a fixed relationship between the negative and positive carbons at all times, if proper crater formation on the positive is to be had. Thus, a slightly warped Suprex carbon, if used with a low-intensity lamp, will require constant realignment as the carbons are consumed.

The feed screws on low-amperage lamps are arranged for an equal ratio of consumption of positive and negative carbons, whereas the burning rate between the positive and negative Suprex carbons may vary from 2-to-1 to 4-to-1, depending upon the current employed.

A special feed screw to provide a fixed ratio of negative feed to positive feed could be installed (*and is in conversion jobs*—Ed.), but this would necessitate operating the lamp at *one fixed amperage* and would not permit the flexibility of operation that is essential in arc lamps using Suprex carbons.

The operation of practically all low-intensity arc controls is governed by changes in the voltage across the arc, which principle is unapplicable to a Suprex carbon arc.

By the time sufficient alterations are made in a low-voltage lamp to make it a satisfactory device for operation with Suprex carbons, the cost entailed would amount to almost as much as a lamp designed specially for operation with Suprex carbons, and of course, the conversion job would never give the results obtainable from a lamp designed expressly for the purpose.

There are, of course, many other reasons why such a conversion inevitably must result in a "botched up" job, most important of which is that people attempting such work are not experienced manufacturers, have none of the drawings of the original parts (necessary if proper dimensions of substituting parts were to be supplied), and the known fact that such manufacturers come and go as frequently as the seasons.

I am afraid that anybody buying such an orphan would be unable to find repair parts when he needed them.

TABLE B. *Comparative Hourly Operating Costs*

Type Arc	Amps.	Arc Volts	Line or Gen. Volts	Current Used	Current Cost	Carbon Cost	Combined Cost
Low-Intensity	30	50	80	5.3 kw.	26.5c	5. c	31.5c
I. P. Figures	30	50	80	3.96 "	19.8	5.	24.8
A. C. Arc	80	25	220	2.2 "	11.	10.2	21.2
I. P. Figures	80	29	232	2.7 "	13.5	12.	25.5
Suprex D. C. With 3-Phase Rectifier	45	35	220	3.5 "	17.5	21.4 and 4.6 bulbs	43.5
I. P. Figures	45	32	220	2.2 "	11.	14.4 & 2. for bulbs	27.4

Proper Screen Selection

J. C. Heck

DA-LITE SCREEN COMPANY

IT IS not my purpose to discuss the comparative merits of Suprex and low-intensity projection but rather to point out the results obtained with the white, beaded and silver screens when used in conjunction with either light source.

From the standpoint of its ability to reflect the incident light satisfactorily to all parts of the theatre, the white screen is the most efficient. However, in order to have proper screen illumination, it is necessary to have a powerful light source such as high-intensity (old style); hi-low, or the new A. C. or D. C. Suprex arc.

The quality and quantity of the light obtainable from the latter type arcs may vary, but with either arc it is sufficient to justify the selection of a white screen. Here we approach the ideal—satisfactory screen brightness from all seats. But—there is the proverbial fly in the ointment.

A large majority of theatres are now equipped for low-intensity operation, and many such houses are using white screens that have outlived their usefulness. Decidedly inferior screen illumination results, and this is the one thing that no exhibitor, no matter what his financial position, can afford.

The remedy for this condition lies in either one of two courses. First, a complete change from present L. I. equipment to the Suprex arc by means of either new equipment or conversion of existing equipment. This change would in either case also call for a new white screen. The second course is to continue using the present L. I. arc and replacing the white screen (if one is now being used) with a silver or beaded screen. In all narrow- and medium-sized theatres this combination will not only assure vastly improved screen results but will also cost much less.

Certainly no one in the projection field is content with poor screen results, and least of all an equipment manufacturer. One must not lose sight of the fact, however, that first cost and maintenance costs are vital factors in any exhibitor's budget. There has been some objection voiced to the allegedly slightly yellow color of the L. I. arc light, to which there was no objection prior to the advent of the Suprex arc. From a box-office standpoint this advantage seems to be unduly stressed. The so-called "harshness" of the beaded and the silver screen is caused by too much light when used with either a straight H. I. or the Suprex arc. This condition does not hold true where the L. I. arc is used.

Confronted with such a problem, the exhibitor will want to assemble all the facts and check the relative merits of arcs, screens, etc., in relation to his own individual requirements. Generally speaking, I should recommend the use of a white screen with all H. I. and Suprex arc installations. Where a L. I. arc is being used, a beaded or a silver screen will give splendid results in all the narrow- or medium-size theatres.

Alliance Sues to Recover Local 110 Funds

Sensational charges of misappropriation of Local 110 funds by the late Thomas E. Maloy and his brother officers were contained in a suit filed in Chicago Circuit Court by the International Alliance. Maloy was killed by gunmen on February 4, and all his lieutenants have since been removed from office by the parent body.

Named in the suit are Effie P. Maloy, widow of the slain union leader and administratrix of his estate, and eleven former officials of Local 110. An accounting of the union's funds is asked, the bill stating that examination of the books disclosed that they "have not been properly kept and balanced." More than $400.000 came into the hands of the defendants for which no accounting was made. it is charged, which amount was "misapplied and converted by said defendants . . . to their own use or to the use of some of them."

Probate records state that Maloy left an estate of $2,000, exclusive of insurance which, under a double-indemnity clause applying to the character of Maloy's death, is said to total $100,000.

Generators, Rectifiers and Bulbs

A leading manufacturer of generators, with long experience in the motion picture projection field, comments on several important aspects of arc power supply.

John Hertner

THE HERTNER ELECTRIC COMPANY

Editor, INTERNATIONAL PROJECTIONIST.

SIR: I was very much interested in your very complete answer to Mr. Hoffman's contention as to the superiority of the A. C. arc, as set forth in your last issue.

There are a few minor points, however, which deserve some notice. Mr. Hoffman states: "In addition there is approximately a 50 per cent increase in power consumption when motor generators are used in an overloaded condition, which means decreasing generator life and upping current consumption from 7 to 9 K. W. depending upon the efficiency of the set."

He had previously spoken of the 30-ampere L. I. arc consuming 5 K. W. from the line. The best information that we have available is that instead of 5 K. W. it is actually between 3.5 and 4 K. W. where the generator produces 30 amperes at 80 volts.

Now, turning to the above quotation, and being somewhat familiar with generators, not only our own, but other makes, I believe I can vouch for the fact that, in general, the generator designed to produce 30 amperes for a L. I. lamp will produce 45 at about the same efficiency.

I have before me a test on a 30-60 Transverter which is probably not far different from other makes of generators. It shows an overall efficiency of 70 at 30 amperes, 71 at 45 amperes, and 69 at 60 amperes. It is capable of continuous operation at 45 amperes. You will note, incidentally, that when delivering 30 amperes at 80 volts, the K. W. line consumption is 3.43 and not 5 K. W.; and that at 45 amperes the line consumption would be 5.1 K. W. and not 7 to 9 K. W.

Now, coming to Mr. Brenkert's article in the same issue[1]. He mentions the life of tubes. The writer has mingled considerably with supply men, theatre owners, and projectionists, and his conclusion is that tube life seems a matter of luck. Recently in an Eastern city a theatre owner was met who was extremely riled on tube expense. The local supply man confided that tubes were the bane of his life because he either made gratis replacements—or made enemies. In some districts the troubles do not appear to be serious and the rectifier is making more headway.

As to the copper-oxide rectifier: while its efficiency is lower than that of the bulbs, being 65 per cent when fan losses, etc., are included, there is a chance that the units will have a considerable life. This, of course, remains to be proven.

Of course, all rectifiers transmit line disturbances to the screen, not having the benefit of the fly-wheel action of the revolving parts of the generator set which will carry the load across a period of low or zero A. C. voltage.

[1] "A Manufacturer's Views on L. I. Lamp Conversion," p. 18.

ARC DATA SUMMARY

(*Continued from page* 19)

observations anent comparative quality.

He first admits that the D. C. Suprex is very good, so good in fact that he draws a direct comparison between this type arc and even the high-intensity arc at 125 amperes. So far so good.

He repeats his analogy between an incandescent lamp and an arc used for motion picture projection, *which employs a shutter*. Shutter flicker, continues Mr. Hoffman, we shall always have with us. In this he is quite correct. So very correct, in fact, that he bears out our contention that flicker, tolerable in a low-intensity lamp, is wholly unacceptable in a high-intensity A. C. arc.

Accepting the statement that the D. C. Suprex arc at 45 amperes gives 50 per cent more light than does the A. C. arc at 80 amperes, Mr. Hoffman seizes upon this fact to drive home the thought that this is precisely the reason why *the D. C. arc gives more flicker than does the A. C.* This statement is unacceptable in the light of established projection practice and in the absence of any data tending to sustain such a theory.

Possibly Mr. Hoffman is confusing travel-ghost with "shutter flicker," which, as far as we know, occurs with D. C. operation *only* when there is excess illumination; and if the latter were true, certainly the field would not have searched long for, and now be eagerly turning to, Suprex arcs.

Reconciling Frequency Difference

The one assertion made by Mr. Hoffman that neither this writer nor any others with whom he has discussed the matter are able to understand—and, let it be said, the most important point under consideration herein—is the procedure followed in reconciling the difference in frequency between the 60-cycle A. C. and that of (48) of the shutter. *This* is, or should be, the focal point of Mr. Hoffman's presentation.

Oscillograph curves to the contrary, this is the one question that must be answered in detail before anybody will give serious consideration to the A. C. arc. Word has filtered through from various sources that there exists a rational answer to this question. but this publication has never been honored with the details thereof.

This writer is positively not suffering from any rectifier complex, as Mr. Hoffman asserts. Motor generator manu-

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—is proving a revelation in screen results and low operating costs throughout the country

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facturers have done themselves proud with the new type sets developed expressly for Suprex operation. Until very recently there existed considerable doubt in the field as to the efficiency of modern m. g. sets, the reason for this being that m. g. manufacturers did absolutely no promotion work and kept the worth of their products more or less a secret. Elsewhere in this section appears an interesting commentary on generator performance by John Hertner.

Mr. Hoffman takes a rather timid swipe at copper-oxide rectifiers, winding up by saying that neither he nor anybody else knows at present just how these units will act after operating in the field over a period of time, the implication being that trouble likely *will* develop.

Now, this writer, while certainly not an expert on copper-oxide rectifiers, is sufficiently well informed (along with hundreds of others), to know that there is no more reason for trouble developing in a copper-oxide rectifier of proper design and having ample capacity than there would be in any other unit of equipment bearing a trade mark of some repute. There is some talk about overloading a copper-oxide rectifier, yet let it not be forgotten that a m. g. set will also develop trouble when operated in an overloaded condition.

To the best knowledge of this writer, no copper-oxide unit of good design and ample capacity that is properly used has given any trouble. This holds good for any unit of equipment, including motor generators.

Only Results Determine Value

Peeved at a statement made herein last month to the effect that a conversion job would leave the theatre with a projection room full of junk, Mr. Hoffman wants to know why. The answer to his query is that, *in terms of results*, this is precisely the outcome of a conversion job, in the same way that even a new

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Detroit, Mich.**

automobile of 1918 vintage would be junk in comparison with even a 1934 model car that had been run several thousands of miles.

That which Mr. Hoffman evidently finds very difficult to comprehend is that any discussion such as this must ultimately be carried on in terms of *results.* Costs are of some interest, to be sure, but a 1918 car, though never run a mile, still would be a mechanical curio today.

Mr. Hoffman presents some interesting cost figures. Table A can be passed as is, except for the qualifying editorial note appended thereto. No projection rectifier has a list of only $160, and nobody that we know of pays $15 each for bulbs.

We might observe in passing, however, that most manufacturers we know would consider the prices quoted in Table A very good—if they could get them.

Table B relates to operating costs and really is the crux of Mr. Hoffman's arguments. The table includes two sets of figures: Mr. Hoffman's and those supplied by this publication and appearing in bold face.

Consider the low-intensity costs. Mr. Hoffman's costs figure out so that he allows a generator efficiency of only 45 per cent, which is plenty low. This naturally ups the k. w. consumption, his figure being 5.3, while that of I. P. is 3.96. The latter figure is exactly that reached by Mr. J. Hertner in his article included in this section. Low-intensity operation at 31.5 cents per hour would be pretty expensive medicine for the small theatre. I. P. differs with Mr. Hoffman here by about 7 cents per hour.

The second unit considered in Table A is the A. C. arc. Mr. Hoffman figures the voltage at 24; while I. P.'s experience is that 29 volts is about right for a proper arc gap. National Carbon recommends a higher voltage. I. P. figures the k.w. at 2.7, as contrasted with 2.2; while current and carbon costs serve to widen the difference. Overall, Mr. Hoffman gets a cost of 21.2 cents per hour, while I. P. figures it to be 25.5 cents.

Incidentally, the 25.5 figure has been okayed by National Carbon Co. and several other independent investigators. Also, it is worthy of note that the National advertised this arc as costing "only a few cents *more* than the low-intensity arc," which would seem to confirm I. P.'s cost findings on that type of arc.

It is when considering D. C. Suprex

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costs that Mr. Hoffman seems to have gone completely astray. Figuring amperage as 45 and voltage as 32 (and not 35), the consumption, based on an efficiency of 65 per cent for a three-phase rectifier, works out to 2.2 k.w., and not 3.5, as cited by Mr. Hoffman. Thus, current costs would be 11 cents an hour, and not 17.5 cents, as Mr. Hoffman states.

Carbon costs for this arc using a three-phase rectifier would be 14.4 cents per hour, which figure has been accepted by carbon representatives and lamp manufacturers. This makes a total carbon-current cost of 25.4 cents. To this should be added 2 cents per hour for tube replacement, based on a price of $11.25 per tube, which is plenty.

Thus, to operate a Suprex D. C. arc for one hour costs 27.4 cents, which figure also was accepted by National Carbon Co. and many other workers in the art.

We are quick to admit that Mr. Hoffman made good on one promise: he did demonstrate to our complete satisfaction that the A. C. arc is cheaper to operate by 2 cents an hour than is the D. C. Suprex. We think that the aforementioned figures will be accepted as representative by practically everybody in the projection field.

But Mr. Hoffman has failed utterly to carry his other major points relative to the worth of the A. C. arc, and he has failed also to convince this writer, at least, that a difference of 2 cents an hour in operating costs justifies any theatre in offering A. C. projection.

Mr. Hoffman admits that the cost of a conversion job would total $500. Now, let it be assumed that a complete new installation would cost $1108, thus saving $600, to which may be added the 2-cent additional hourly operating cost of $73.00 per year. Thus, for something like $1.40 weekly a theatre can present projection for which no excuses need be made.

On the point of first costs, it is true that Mr. Hoffman has made out a case of about $600 in favor of the conversion process. But this writer maintains that after conversion, as previously outlined, the theatre still has a misfit projection room, with the lamps utterly unfit for duty with the copper-coated carbons on the single point of optics. Other considerations there are, of course, as set forth herein by several lamp manufacturers.

Standards—Or None

It should be remembered that Suprex projection was introduced as an aid to good projection, to perk up theatre screens with a magnificently improved screen light. It was not introduced for the pikers, to speak plainly, which is this writer's estimation of any theatreman who would elect to convert rather than

buy new equipment. Subscribing to Mr. Hoffman's views anent the A. C. arc and, secondly, on conversion jobs, it is apparent that this point of view carried to its logical conclusion would ultimately mean the vanishing of any semblance of projection standards—whether the consideration be lamps, lenses, screens, or any other unit of equipment. Thus the cost picture.

Considering the technical side of the question, it is apparent that this discussion is utterly ridiculous. Mr. Hoffman makes no attempt to contest the evident superiority of the D. C. Suprex arc as a light source; in fact, freely admits it.

The A. C. arc will always appear to this writer to be a technical bum, a projection outcast, and this sentiment applies also to conversion jobs.

ELECTRIC SHOCK

C. J. McGlogan

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Effects of electric shock on human beings and animals have been studied exhaustively during recent years by Dr. W. B. Kouwenhoven, assistant dean, School of Engineering, Johns Hopkins University. Some of his findings constitute information which should be possessed by all who work with electrical circuits.

For example, he has found that low-voltage alternating current is more dangerous than low-voltage direct current; that high-voltage direct current is more dangerous than high-voltage alternating current; that high-frequency circuits are relatively harmless, and that with sufficiently good contact 60 volts can kill. With a given condition of contact resistance, he has found that 10 volts caused a flow through several persons of one milliampere of current, 20 volts produced 2.5 milliamperes; with 30 volts it was 12, and with 40 it was 20 milliamperes, under which condition only one of the recipients could release the electrodes.

The path of the current he has found to be important, being most dangerous if it includes the heart. It has been found that 110 milliamperes, flowing from the hands to the feet, can kill. The time factor is important, however, one case being on record in which the victim carried 28 amperes for a brief period without fatality.

The several effects of electric shock can be divided into four classifications as follows: 1, the victim is burned or cooked; 2, brain cells are destroyed; 3, heart action is stopped; 4, breathing is stopped. The first two conditions may not be corrected by emergency treatment, but the pain of an electric burn can be relieved as that of any other burn. A heart that is stopped will often start again if artificial respiration is resorted to.

Sometimes electric shock will cause fibrilation or fluttering of the heart, under which condition insufficient blood is pumped and the heart continues to flutter until the patient dies. This can be corrected by a saline treatment or by the administration of a stronger shock which stops the heart, after which it will start again. These treatments can only be given by a specially trained person, but fortunately, the conditions which require them are not the usual results of electric shock.

Most Common Effect

Probably the most common effect of electric shock is a blocking of the nervous system which causes the lungs to cease functioning because they receive no message from the brain. It is for this reason that artificial respiration is so effective in reviving victims of electric shock.

The Schafer prone pressure method of resuscitation is offered by Dr. Kouwenhoven as the most effective. It may be supplemented by an inhalator which adds oxygen to the air as the patient is caused to inhale; he does not look upon the pulmotor with favor, since it may cause bleeding. The vital requirement is to start artificial respiration immediately and continue it without cessation.

A trained emergency squad will change or relieve operators or wrap the victim in a blanket without depriving him of a single breath. They do not stop be-

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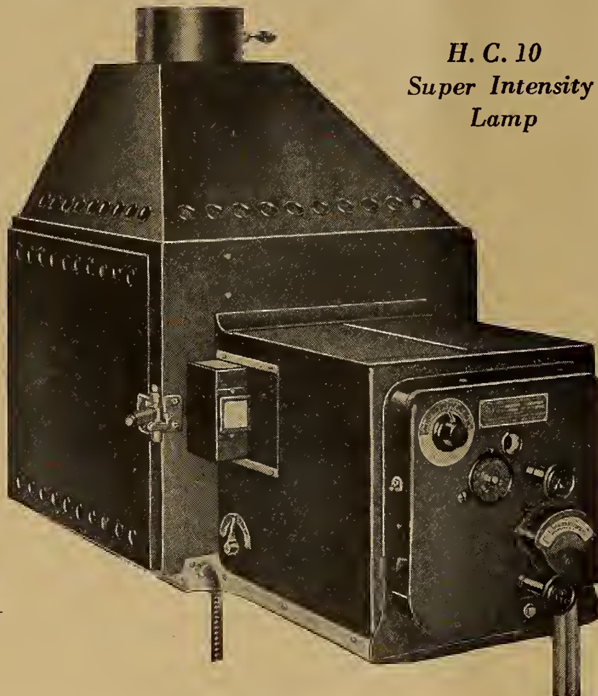

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cause a hospital attendant says he can detect no heart action. Rather they continue until the victim is revived or until rigor mortis sets in. People have been revived after eight hours of artificial respiration.

Instructions are or should be available in every shop and all employees should be familiar with them. The need is infrequent, but it is vital, and it is probable that numerous lives have been sacrificed because those in attendance have not known how, or have neglected to act because they were embarrassed by their limited knowledge of what to do. The man on the job who acts quickly and who does not quit is worth more than 100 skilled physicians who cannot reach the victim for half an hour.

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The fifth annual convention of the Independent Theatre Supply Dealers Assoc. will be held at the Edgewater Beach Hotel in Chicago, June 15 to 18, inclusive. Various phases of policy will be discussed, officers will be elected, and an advertising and publicity campaign will be considered.

More than 35 manufacturers will exhibit their products at the convention, according to President J. E. Robin.

BACKGROUND PROJECTION IN STUDIO WORK

(*Continued from page* 17)

ter opening of 270 degrees, as compared with 180 degrees for the claw-movement type. The picture can be framed, whereas with the other type it can not;

the intermittent works cold: only the film is exposed to the heat, whereas in the claw type machine the claw and pins are continuously exposed to the heat, and subject to expansion.

Arc, Lenses, and Screen

The lamp is a Hall & Connolly *HC*-10, of the thermostatically-controlled type, using 13.6-mm. positive and 11-mm. metal-coated negative carbons. The current is 165 to 200 amperes. The condensers are standard 5127 for the rear, and 5128 for the front element. The position of the condenser lenses with respect to the arc and projector differs from that in ordinary theatre projection, owing to the necessity of eliminating the hot spot which ordinarily would appear upon the screen after the re-photographing.

The projection lenses are the Apermax-Cooke 5½-inch f/1.9, and the 6½-inch f/2.3. These lenses proved to be superior to any other lenses tested so far.

In the beginning a Trans-Lux screen was used, having very good diffusion but low transmission, thereby handicapping scenes requiring big picture sizes. However, it proved very satisfactory so far as the hot spot and satisfactory viewing angle were concerned. Later a rear projection screen made by Fox on the West Coast was obtained, having nearly double the transmission of the Trans-Lux screen but a narrower satisfactory viewing angle.

Photographing the plate requires experience and skill on the part of the cameraman in charge. He must visualize in advance what the projected image should be, and looking through the finder of the camera when photographing the plate he must take into consideration the foreground that will be in front of the screen when making the composite scene. Moreover, he must judge accurately the exposure required for a negative density contrast of 0.80 to 0.95 after the film is normally developed.

When buildings or other subjects that must appear steady on the screen are photographed, the camera must stand very steadily upon its tripod, which may have to be tied down. When photographing from bridges, long focal length lenses must be avoided because of the vibration of the bridge. Wind also causes unsteady negatives, and it is suggested that plates be not photographed on windy days.

Careful Advance Tests

From the finished negative plate three positives are made: one called "normal", another one printer-light higher, and the third one printer-light lower. From these prints the one best suited to the composite scene is chosen. These prints are special in so far as they are made on a selected step printer. For lining up the scene an ordinary print made on a continuous-running Bell & Howell printer is used. Each work print is preceded by 15 feet of a sharp criss-cross chart to permit focusing the picture accurately.

The actual operation is as follows: Required sets and props are built and erected before the translucent screen. Necessary lighting equipment is approx-

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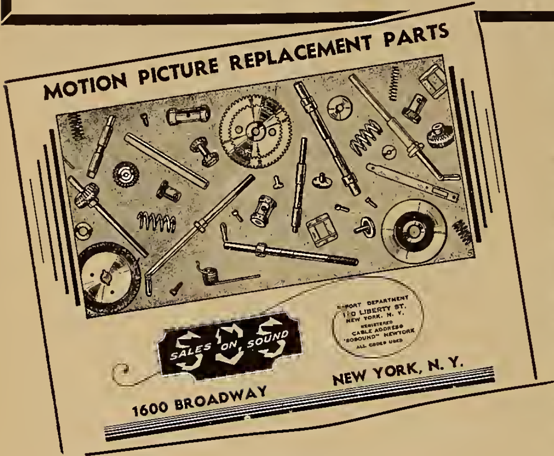

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imately placed in position. Plenty of gobos are on hand to shade the screen from light striking the foreground.

A projected picture of the approximately correct size is thrown upon the screen. If the size is not satisfactory, lenses are changed, or the projection machine is moved to attain the desired result. Then the lighting is balanced by measuring first the light striking the foreground, and then the intensity of the projected light. The measurements are made with the Weston photronic meter.

A final photographic test is made as follows: The foreground is illuminated, an interlocking phase is switched on, and the camera shutter is set to a standard position. Then the clutch of the projector is closed in the corresponding shutter-synchronizing position, and the projector and camera are operated synchronously for about 30 feet of film. From the end of this test-exposure two feet are developed and fixed by hand, and then enlarged on paper so as to show what changes might be required. After obtaining a good test, the scene is finally photographed and recorded.

In conclusion, the author expresses his sincere appreciation to Messrs. L. W. Davee and H. Griffin who cooperated in making this background projection process a success.

Discussion:

CHAIRMAN CRABTREE: In the scene where the girls were seated on the parapet and the boys were going through their antics in front of them, the girls didn't seem to be in the least interested in what the boys were doing. Obviously, if there are any animate objects in the picture when the background scene is shot, they ought to be doing what you intend them to be doing in the composite picture.

How are screens made? Originally ground glass was used, but I understand that most screens consist of fabric sprayed with, say, cellulose acetate or some similar transparent material.

MR. POPOVICI: I can not give you any definite information on cellulose screens, because we used only the Fox screen, which, so far as I know, is made by spraying certain materials upon a flat plate of glass, and then peeled and processed in a secret way.

As regards the Trans-Lux screen, which was used on the shots you saw today, it is silk impregnated with gelatin with a little color pigment in it. The gelatin is pressed against a matte surface in such a way as to provide a high diffusion factor. The transmission of the screen is, however, very low: the one we have used so far transmits only 17 per cent of the light. The viewing angle decay is very, very small, even enabling us to make shots when running with a camera from the side, or in and out, without difficulty or without any difference of density in the re-photographed image.

On the Fox screen, however, the slight-

est angle that is introduced between the camera and the projection axis will cause trouble. It is a high-transmission screen, however, transmitting 30 per cent of the light and enabling one to balance out the front lighting very easily in order to attain a good overall balance of lighting. The "hot spot" is a little more noticeable on a Fox screen than on a Trans-Lux. That is why we place the projection machine as far as we can from the screen.

Mr. Mitchell: You said that you use the condensers to eliminate the hot spot. Can you give us any details?

Mr. Popovici: It has been a very empirical procedure. The Bausch & Lomb specifications require that the condenser be set about 14 inches from the projection machine aperture and the distance from the carbon to the condenser lens about 8 inches. I arrived at my settings, as a matter of fact, after much experimenting, measuring the light on the other side of the screen with a Macbeth illuminometer and a Weston photronic meter. I found a large difference between readings made with B. & L. specifications and our own. The distance between the condenser lenses remains unchanged. The lamp house is pushed back 21½ inches, and the distance between the condenser lens and the carbon is only 3 inches, instead of 8.

The projected concentrated spot from the condenser lenses on the aperture is quite characteristic in that a concentrated spot of great intensity covers the aperture, and from that point on, the remainder of the circle, which is not used, is of lower intensity. We try to get collimated light, which would be ideal for that kind of process, but so far we haven't been able to get it with sufficient intensity for all requirements.

Mr. Frank: In most instances are the original outdoor scenes taken specifically for the picture, or do you have a library? Are sound effects ever recorded with the original outdoor scene, or are they always dubbed separately onto the final film?

Mr. Popovici: There is, so to speak, a small library for outdoor scenes, but we do not use it for shots that have to be steady. We would rather send out a cameraman to shoot a new scene, because the negative has lain quite some time in the vault and has shrunk, and it is difficult to print a shrunken negative. It is cheaper to make the shot anew. For scenes of the kind required for taxicab shots or running automobiles or trains, where steadiness is not required, we use library shots, of course. Synchronizing the sound effect is usually done in dubbing.

Mr. J. Crabtree: I believe those are Bell & Howell perforations on the negative and square perforations on the print. Have you used the same kind of perforations on both negative and print?

Mr. Popovici: We use exclusively the Bell & Howell perforation all the way through.

Mr. J. Crabtree: Is it preferable to the square perforation?

Mr. Popovici: It is, because the print has to be very steady, and running Bell & Howell perforations against Eastman perforations would be quite a difficult task.

Mr. J. Crabtree: But the Society has recommended the adoption of the square kind of perforation throughout.

Chairman Crabtree: The question is why would not the square perforation with the square pilot pin be just as good as the Bell & Howell pilot pin with the Bell & Howell perforation?

Mr. Popovici: It would be, so far as pertains to printing, but in printing there are two sprocket holes to accommodate. The negative has shrunk a small amount, and the positive fresh stock has not shrunk. If you take a positive stock that will fit snugly upon a pilot pin, this undeveloped stock will be too big for the hole of the negative that has been developed and shrunk, and you will have to force the negative over the pilot pin.

Mr. Ricker: I want to add one word of caution. Sometimes a cameraman or laboratory man will have occasion to rewind film. Since in the film factory the film is undoubtedly edge-guided during perforation, after slitting the film from an edge-guided side, you must be careful to keep that same edge-guide inside, both in the camera and in the projector, because you will find when it is edge-guided for perforation on one side, reversing the film and projecting it guided on the other side will result in a variation in the position of the perforations.

Mr. Popovici: That is true. As a matter of fact, we know which side is guided during perforation and we always try to keep the same side guided all the way through.

Oversized pins are very good in optical printing where you make two or three pictures a second. But when the movement is fast, you will agree that the sprocket hole is definitely deformed when it goes over the pilot pin. Disregarding printing, and considering now projection, the projection machines on the coast are all equipped with pilot pins. The pins start to work in the cold state; when 200 or 300 feet of film are shot on the screen, the pilot pin becomes hot and expansion occurs. The film has a tendency to shrink from the heat; the pilot pin swells. What results? A steady shot in the beginning, but movement the third time it is shot.

Mr. Mitchell: I always thought the machine was warmed up before starting.

Mr. Popovici: Perhaps; but there are two factors working against each other. In side-guiding the film isn't forced at all; the only pressure that acts comes from the springs that hold the film against the gate. Three sprocket teeth, instead of one pin, engage the film; hence the torque of the sprocket drum against the film is so much less than on a pilot-pin movement. However, the motion is twice as fast, which balances it out, and still it is a little less than with the pilot pin.

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THREE DIMENSIONAL MOVIES 'RE-INVENTED' BY LUMIERE

(*Continued from page* 11)

than twenty years, if not longer. We have no objection to numerous periodicals advertising the Lumiere "invention," but we are a bit worried that some few I. P. readers might have been misled by this insidious publicity blast.

Mr. Griffin Reminisces

At this juncture we step aside and offer the following commentary on the Lumiere "invention" by H. Griffin, known far and wide as, among other things, general sales manager for International Projector Corp. Observes Mr. Griffin, apparently with some heat:

"I am attaching herewith clipping from the *New York Times* which gives Lumiere credit for the 'invention' of stereoscopic projection of motion pictures by the two-film projection method and the use of red and green screens held in front of the eyes.

"Why the *Times*, or any of the numerous other newspapers and magazines, should give so much space to such a ridiculous assertion I cannot understand. Twenty years ago at the Ziegfeld Follies (in New York) slides were projected in just this manner, and, of course, they appeared completely stereopticon when viewed through the red and green filters. Naturally, the audience was impressed this once by such a novelty.

"Pictures using this particular method have been made and projected on Broadway (N. Y.) several times during the past twenty years, and you undoubtedly remember Teleview which was put into the Selwyn Theatre a great many years ago. This process employed the same method of projection but the viewing was done through a synchronously-revolving shutter. This was far better than looking through red and green eyepieces; but anything which the audience must hold or have placed before their eyes is, as you know, wholly unsatisfactory. Of course, with sound pictures the whirling of synchronous shutters would be out of the question.

"The most disturbing factor is that editors of the *Times* department in which the Lumiere story appeared, and a majority of other writers and editors, evidently know so little about our business that it is a cinch for anyone to buttonhole them and hog considerable space for fantastic stories about motion picture technical matters.

"You will recall that early in January I was responsible for the introduction of a complete sound motion picture show in a Douglas airliner. A couple of weeks later in the same "technical" department of the *Times* there appeared a picture and story of a similar installation in a Russian airplane (although no part of a plane was visible in the photo). Whether the installation was for sound or silent pictures was not disclosed.

"I cite this instance merely to stress the point that there is plenty of good material right at hand for use in the *Times* technical section and elsewhere without having to rely upon the products of foreign 'inventors', most of which are antiquated from our point of view."

Beyond which there remains to be said only that, given an uninformed public possessing an enormous capacity for believing in the printed word, there is no limit to the force that can be put behind almost any vagabond idea.

NRA is Still Passive in N. Y. Picketing War

Despite the continuance of a picketing barrage in New York City which involves three projectionist unions and has extended to the deluxe theatres on Broadway, Divisional Administrator Sol A. Rosenblatt has announced that he will "give the situation no more of his time" until Congress acts upon the proposed extension of the NRA.

One of the unions involved is the Allied group, termed by the New York Supreme Court as an out-and-out "company union." Allied pickets parade before Local 306 theatres carrying cards stating that the theatres are "unfair to organized labor." Empire is the third unit concerned.

Despite a raft of pronouncements beginning in September, 1933, and numerous outwardly brave gestures, NRA has consistently ducked doing anything about a situation which practically all impartial observers insist is a "disgrace to the NRA" and an unwarranted imposition upon New York theatres who hire bona fide union employees.

S. M. P. E. Spring Convention at Roosevelt Hotel, Hollywood, Calif., May 20-24, inclusive.

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Television and the Motion Picture Theatre

By DR. A. N. GOLDSMITH

STEP-BY-STEP ANALYSIS OF AMPLIFIERS—RCA SYSTEM OF RECORDING—THE S. M. P. E. HOLLYWOOD CONVENTION—NEWS AND VIEWS—CRAFT ITEMS—TECHNICAL HINTS

May 1935
Vol. 8 No. 5
In Two Sections

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Section I

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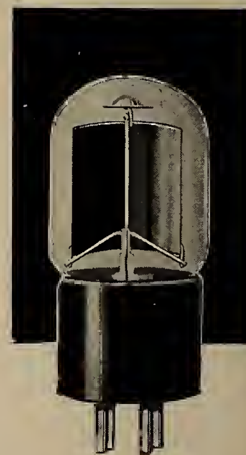

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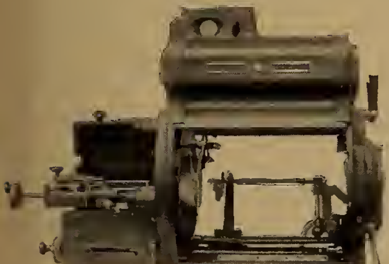

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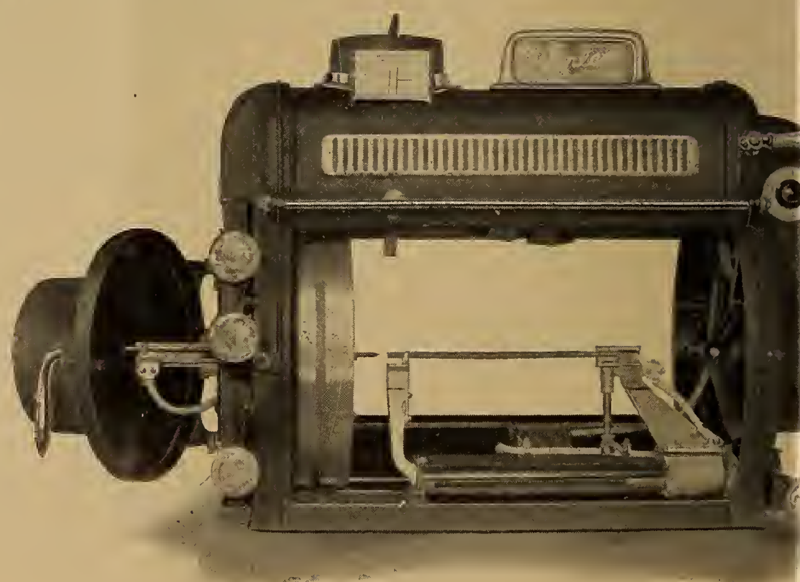

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"THE WORLD'S LARGEST MANUFACTURER OF PROJECTION ARC LAMPS"

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 8 MAY 1935 *No.* 5

Index and Monthly Chat	5
Step-By-Step Analysis of Sound Reproducing Equipment, X AARON NADELL	7
Advances in Recording, Reproduction Cited by RCA Chief Engineer	10
Brushes: Their Use and Relation to Motor Trouble L. L. STOFFEL	11
Sharp Division of Craft Opinion on I. P. Print Footage Publication	12
Television, Color Feature S. M. P. E. Coast Meeting	13
Questions and Answers on Sound Projection	14
Television and the Motion Picture Theatre A. N. GOLDSMITH	15
The Editorial Page	17
Craft-Engineer Relations Cited by I. A. Pres. Browne to S. M. P. E.	18
The 'Point System' of Estimating Projectionist Wages	19
News Notes	20
The New RCA Sound Track JAMES FRANK, JR.	21
Letters to the Editor	22
Max Ruben	22
Metal Tubes Induce Stiff Trade Fight	24
Technical Hints	
Miscellaneous Items	

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420

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MONTHLY CHAT

FOOTAGE calculation is a matter of grave concern to projectionists in the subsequent-run theatres, according to the deluge of mail which hit this office following our inquiry as to preferences in this matter. The results are inconclusive, however, being split evenly in favor of and against publication of footage figures. More about this controversial topic herein.

DISAPPOINTING to us were the presentations on color by alleged "experts" at the recent S. M. P. E. convention in Hollywood. Proponents of this struggling art spilled many words about art forms and psychological reactions and warm color hues, but nobody made a practical contribution along the line of explaining how, with color negative costing 5.6 cents per foot as against the 1.8 cost of black-and-white, the industry is going to get its money back.

A 25 per cent rise in costs might be digestible, even in the light of a record showing no box-office advance when sound pictures came in.

SAN FRANCISCO projectionists report to I. P. a steady rise in the number of theatres receiving sound equipment servicing from the local organization. Aggressive though this organization be, we have never heard that it holds the copyright on this idea. Go out and get this work.

ENGINEERS and projectionists must respect each other's rights, I. A. President George E. Browne told the S. M. P. E. in an address to the Society's recent convention. The I. A. leader lauded the accomplishments of the engineers, but added that he knew of no reason why either the engineers or the projectionists should attempt to encroach upon the domain of the other. Published in full herein.

ONE must be both deaf and blind not to perceive the radical changes impending in the production and reproduction fields. Color, television and, possibly, three-dimensional films are in the offing, constituting a challenge to the capability, ingenuity and courage of the craft. I. P. will do its share, of course, in charting the development of the art.

THE Academy of M. P. Arts & Science has formed a television committee. This is O. K. with us; but we do wish that the Academy would finish one job before it hops to another. Reel length, for example, has been under consideration by the Academy for three years now, with no answer as yet. Incidentally, Boston Local 182 advises that 1000-foot reels will be used by its members as long as the organization has anything to say about it.

FASTER

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INTERNATIONAL PROJECTIONIST

VOLUME VIII NUMBER 5

MAY 1935

STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING EQUIPMENT

Aaron Nadell

X. Control Circuit Analysis

FIGURE 1 is the schematic drawing of a voltage control cabinet designed to correct variations in commercial a. c. supply to the projection room. It looks simple but is really a bit tricky, and is ideally suited for those projectionists who are interested in analyzing circuits.

The two tricky items in Figure 1 are the transformer and the lower left-hand switch. The transformer layout is unusual in that all its windings seem to be connected to the source of power and consequently there may be some difficulty in determining just which winding is the primary. The lower left-hand switch, KS-6203, is extraordinary in that it is wired precisely like a polarity-reversing switch in a d. c. circuit, when it obviously operates only on a. c.

The key to understanding this drawing lies in studying Coil 5-6 of the transformer. This coil is connected *in series* with both the load and the line. Obviously, current flowing from the line to the load must pass through this coil, and it is equally plain that any secondary voltage generated in that coil must either aid or oppose the line voltage.

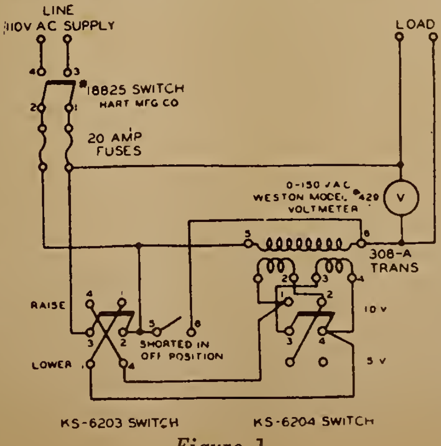


Figure 1

Coil 5-6, then, is the secondary of the transformer, the purpose of the polarity-reversing switch in an a. c. circuit being revealed at once. By reversing the polarity to the transformer primary, the voltage generated in Coil 5-6 will either increase the line voltage (because it is both in series and in phase with the line), or it will reduce the line voltage because it is in series but 180 degrees out of phase, and therefore "bucking" the line.

Function of Switch KS-6204

One small puzzle remains to be solved, and that is the function of the right-hand switch, KS-6204. The fact that the primary of this transformer is wound as two separate coils, 1-2 and 3-4, suggests the answer. This must be a step-down transformer, since 110 volts flows in the primary and only a small bucking or reinforcing voltage is desired in Coil 5-6.

Now, the degree of step-down must

depend on the ratio of primary to secondary turns. The greater the number of turns in the primary the greater will be the step-down, and the lower the voltage generated in Coil 5-6.

Switch KS-6204 is obviously intended to put Coils 1-2 and 3-4 in series with each other or in parallel with each other, as desired. When they are in series the number of turns in the primary winding is doubled, and the voltage generated in Coil 5-6 is halved. Just to the right of this switch we see two guide figures—"10 V." and "5 V." These alone tell us that when this switch is in the lower position, Coils 1-2 and 3-4 are in series, a fact easily confirmed by studying the wiring in detail.

Having thus far analyzed what this apparatus does and how it does it, we can proceed to trace the circuits step-by-step. Without the foregoing, tracing interlocked circuits in detail would be unproductive of anything but confusion.

The line power enters at the upper left, through switch No. 18825 and a pair of 20-amp. fuses, and passes through the cabinet to the load terminals at the upper right. One of the two legs of this line contains Coil 5-6 in series. A wire runs from Point 6 of this coil left about an inch and then down to Point 6 of a single-pole, single-throw switch. The drawing reads: "Shorted in Off Position"; apparently this single-pole switch is part of KS-6203, and closes when KS-6203 is turned to "Off."

Reference to Figure 2 shows that Switch KS-6203 does, in fact, contain terminals numbered 5 and 6. Therefore when KS-6203 is turned off, no power is supplied to the transformer, no voltage is generated in Coil 5-6 and that coil is short-circuited. When Switch KS-6203 is in "Off" position the full line voltage flows directly to the load precisely as if this voltage control cabinet did not exist.

Circuit for Switches

When Switch KS-6203 is placed in "Raise" position to increase the line voltage, the short-circuit is removed from Coil 5-6, which then becomes operative. Two positions are possible for Switch KS-6204.

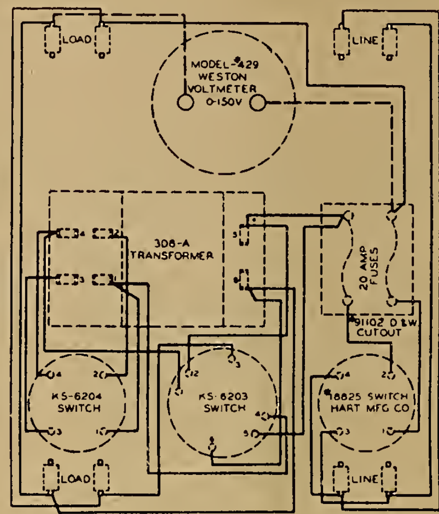


Figure 2

Let us assume KS-6204 to be in the 10-volt position. (Both switches are now "Up.") Tracing the circuit from the left-hand side of the supply line, it runs: down, right and down to Point 2 of KS-6203. Up through the switch bar to Point 1, diagonally down-left to the other Point 1, and down, right and upward to Point 4 of KS-6204.

Here the circuit breaks into two branches: one runs directly through Coil 3-4 of the transformer to Point 3 of the switch, and upward through the switch bar to Point 1 of the switch. The other branch runs upward through the switch bar to Switch Point 2, thence through Coil 1-2 to unite with the other branch at Point 1 of the switch.

From this junction the circuit may be traced down and left to Point 4 of KS-6203, diagonally up-left to the other Point 4 of that switch, down through the switch bar to Point 3 of KS-6203, and thence upward to the right-hand side of the line.

In the circuit, as just traced, the line voltage has been increased by ten volts, the two halves of the transformer primary being in parallel.

Now, with KS-6203 up, let us put KS-6204 down, in the "5 V." position. Lower Point 1 of KS-6203 is still the left-hand side of the power line. From that point we follow right and up to Point 4 of KS-6204. (This switch is now down.) Thence upward, through Coil 3-4 to Point 3 of KS-6204. From Point 3 downward through the bar of the switch, and thence right-upward to Point 2, through Coil 1-2 and down-right to Lower Point 4 of KS-6203.

The two transformer windings are now in series, the number of turns in the primary has been doubled, the secondary voltage is therefore less, and only five volts has been generated in Coil 5-6.

In the same way we might put Switch KS-6203 in "Lower" position and trace through both positions of KS-6204, but that would be essentially repeating what has just been done and to no particular advantage. That change merely reverses the polarity of the line. As just traced, the left-hand side of the power line fed into Point 4 of KS-6204. With KS-6203 down, the left-hand side of the power line feeds instead into Point 1 of KS-6204.

This control cabinet is capable of five positions: either a 5- or a 10-volt increase in voltage, or a 5- or a 10-volt decrease in voltage, and—fifth position—no change in the line voltage, when KS-6203 is "Off" and Coil 5-6 short-circuited.

Figure 2 is the wiring diagram of the same apparatus and shows the physical arrangement and appearance of the component parts. We note that the switches we have just examined are not knife switches but rotary snap switches. We cannot trace their circuits in Figure 2, but since their terminals are numbered in both drawings we can easily understand Figure 2 by reference to Figure 1.

One other point of interest about Figure 2 is that the Line and Load terminals are paralleled at both top and bottom of the cabinet, for convenience in connection to a conduit brought in from either above or below. This device, of course, is useful only with a. c., since d. c. will not actuate the transformer.

A Simple D.C. Control Circuit

A very simple d. c. voltage control circuit is shown in Figure 3, which is a voltage regulating device used with either a 110-volt commercial power line, or with the d. c. side of an arc supply generator. It controls the d. c. voltage to loud speaker fields. Very similar circuits are sometimes used to regulate a. c. voltage to amplifiers.

The input to Figure 3 can be seen at the left, marked "Line + and —." This input may be anywhere from 60 to 130 volts, depending on the source. The output to stage horns and monitor is seen at the extreme right. All stage speakers

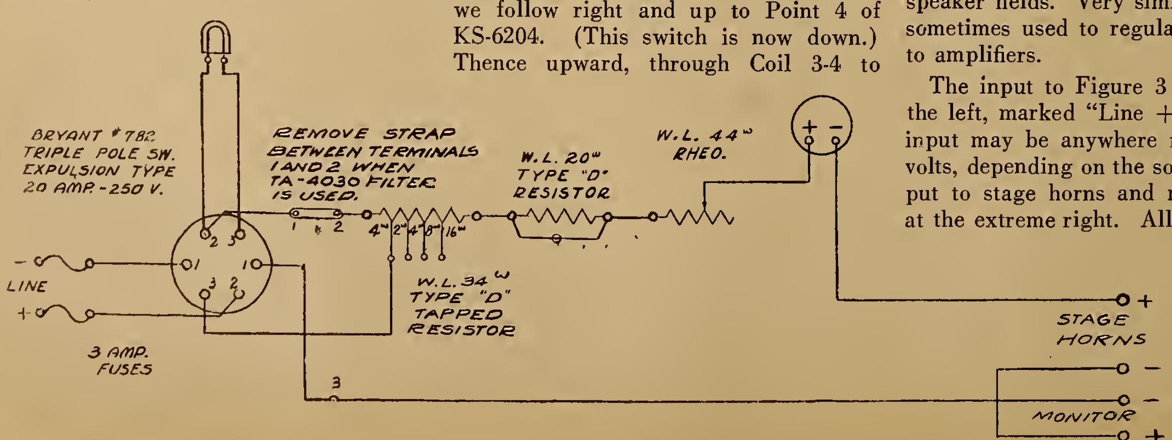


FIGURE 3

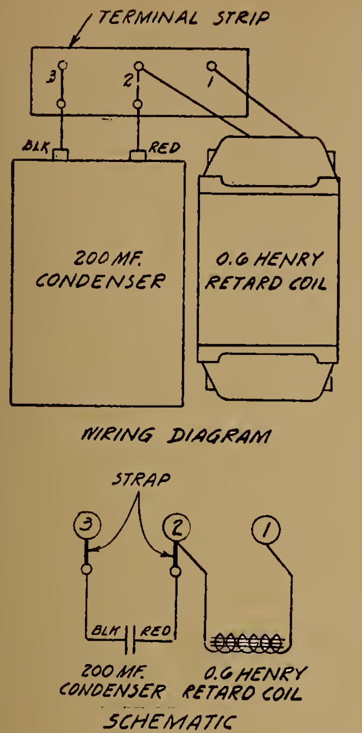


Figure 4

are wired in series through a control box mounted backstage. The monitor is in series with the stage speakers, as may be seen at the right-hand side of Figure 3.

The circuit there, from positive to negative, is: out at the "Stage Horn +" terminal, through the stage lines and back into Figure 3 through the "Stage Horn —" terminal, then left, down and right to the "Monitor +" terminal, through the monitor, in at the "Monitor —" terminal, left about three inches and up to Terminal 1 of rotary snap-switch.

Since all speakers are wired in series, the current through this cabinet is always the same, 1½ amperes for the type of speaker field Figure 3 is designed to serve. The output voltage varies from about 8 to 65 volts, according to the number of speakers used, the maximum number of which, requiring about 65 volts, cannot be used of course in theatres where the input voltage available is only 60—that is, where the power supply is a low-voltage arc generator.

TRACING the circuit of Figure 3 from left to right, the only feature not wholly obvious is the wiring of the 6-volt signal lamp. This lamp is intended to indicate, at a glance from any part of the projection room, that the switch of Figure 3 is turned on; but it is not wired in series with the speakers. If it were, the show would stop anytime that lamp burned out. On the other hand, it cannot be wired directly across the input line, because if it were, some theatres would need a 60-volt lamp, some an 80-volt lamp, and so on.

By wiring this lamp across the 4-Ohm tap of the Type D tapped resistor, a 6-volt bulb can be used in any theatre, since the current flowing through that resistor is always 1.5 amperes. By Ohm's Law 1.5 amperes through 4 ohms creates a voltage difference of 6 volts.

Referring to the snap-switch, the positive input is to Lower Terminal 2, thence across the bar of the switch to Upper Terminal 2. Here the positive side of the lamp is tapped to the main circuit. Continuing, the positive line runs through the strapped contact studs 1 and 2 to the tapped resistor. From the 4-ohm tap of this resistor a wire runs back to Lower Terminal 3 of the switch, through the switch bar to Upper Terminal 3, and thence to the negative side of the lamp. The lamp, then, is connected in parallel to that portion of the tapped resistor which lies between its left-hand end and its 4-ohm terminal.

The drawing shows the entire tapped resistor in use, but in practice part of it may be cut out of the circuit by removing the connecting wire from its right-hand end, as it is shown in the drawing, and attaching it instead to one of the tap connections. The object of this tapped resistor is to adjust the input voltage to such value that the W. L. 44-ohm rheostat, seen further to the right, will always be in roughly center position when the ammeter shows 1.5 amperes, regardless of the input voltage. The rheostat can then be adjusted freely to compensate for minor variations in the input voltage during the day.

The tapped resistor has a total of 34 ohms. Therefore, with 1½ amperes flowing through it the maximum voltage drop obtainable by this device is 51 volts. An additional 66-volt drop can be obtained by adjusting the W. L. 44-ohm rheostat, making a total of 117 volts drop. This, however, would require setting the rheostat for maximum resistance.

The designers of this cabinet have thought well to include an extra 20-ohm resistor, shown short-circuited in the diagram. By removing the short-circuiting wire an additional 30-volt drop can be secured. This cabinet can be used therefore to supply two 7-volt speaker fields (one stage speaker and one monitor) from a 110-volt d. c. line (the voltage of which may on occasion rise to 130 or even higher) and still maintain very accurate control by means of the rheostat.

In practice, the only time the voltage drop through these resistors need be figured is when the cabinet is first installed. The tapped resistor is properly connected at that time, and the short-circuiting strap removed from the 20-ohm resistor; if desired; thereafter all necessary adjustments are made by resetting the rheostat to secure a 1.5-ampere reading on the ammeter, which is shown just right of the 44-ohm rheostat.

The strapped terminals 1 and 2, seen between the rotary switch and the tapped resistor, are used when the source of d. c. carries a ripple heavy enough to cause hum in the sound. In that case a filter must be provided, consisting of a choke coil in series with the line and a condenser in parallel to it.

The choke coil is wired in series by connecting it to terminals 1 and 2, removing the strap. The condenser is placed across the line by wiring it to terminal 2 and terminal 3, the latter shown in the negative side of the line, about an inch below terminal No. 2. The filter is supplied in a separate cabinet which is equipped with terminals numbered 1, 2 and 3, corresponding with the numbers in this drawing. Connections are made by wiring Terminal 1 of the drawing to Terminal 1 of the filter cabinet, etc. Fig. 4 shows the filter.

Figure 5 shows the external connections of Figure 3, including the filter. The interest here lies in the way these circuits are arranged to reveal trouble of any kind with scarcely any delay. The necessity for such arrangement is that with this apparatus the whole speaker power supply is one series circuit, and a break anywhere stops the whole show, including the monitor. The fact that weak sound still will be heard when speaker field power is interrupted is sufficient indication of the nature of the fault.

Figure 5 shows an arrangement of

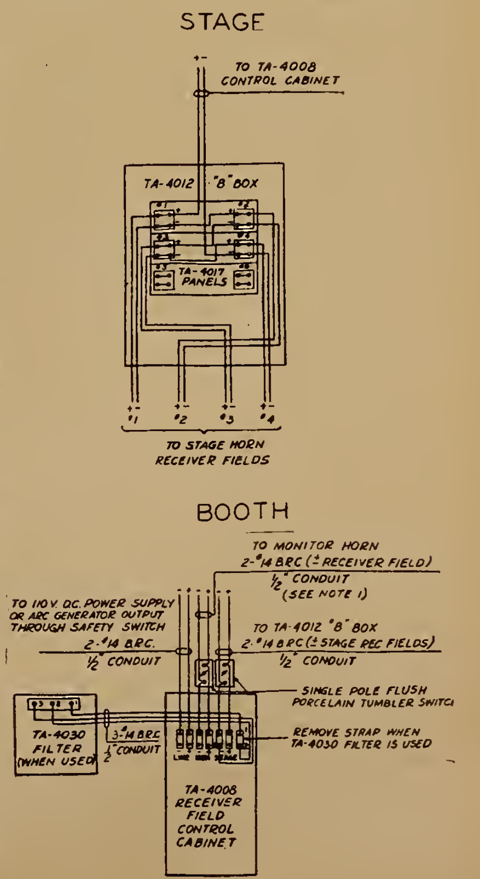


Figure 5

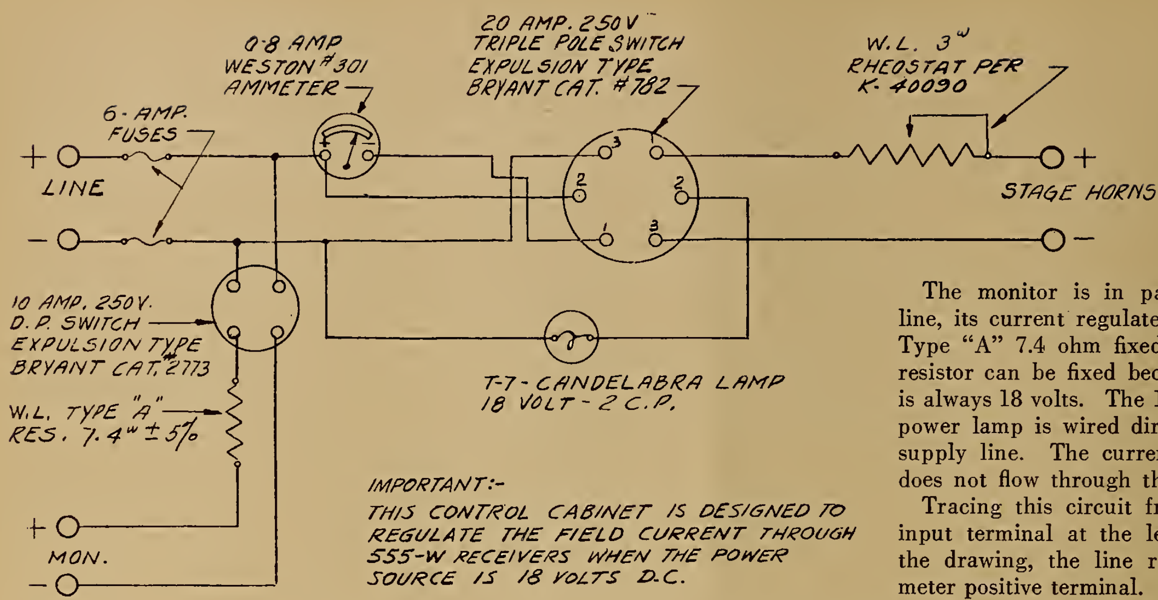


FIGURE 6

switches intended not only to reveal the exact point of trouble in a few seconds, but also to restore the show in an almost equally short period of time.

The left-hand side of Figure 5 shows the TA-4008 receiver field control cabinet that is diagrammed in detail in Figure 3. To the left of it is its filter. Above it, installed with the connecting conduit, are two single-pole tumbler switches. One short-circuits the stage line, one the monitor line. Assume a break anywhere in this long and complicated series circuit, reducing sound volume to a faint whisper. A snap of the stage-line short-circuiting switch will reveal whether the break is backstage. If it is, sound will immediately return to full volume in the monitor. (Also the ammeter in Figure 3 will go off-scale, because all the backstage resistance has been removed.) Conversely, restoring the stage lines and short-circuiting the monitor will restore sound to the house, if the break is in the monitor line.

Backstage Breaks

If the break is backstage, with more than one speaker there, the job of finding out which one has open-circuited is simplified by the switching cabinet shown on the right-hand side of Figure 5. The stage crew (or the projectionist) short-circuit each speaker line by means of the switches in the "B" box. When the faulty line is short-circuited, sound resumes at full volume and the necessary splicing or speaker replacement can be attended to at leisure. All that is needed meanwhile is to readjust the rheostat in Figure 3 to compensate for the loss of 4.6 ohms from the series circuit.

If the two switches shown at the top of the left-hand half of Figure 5 do not restore sound, either to the monitor or the stage speakers, then the trouble is in the apparatus of Figure 3, or in the power source. Finding and fixing the trouble then becomes a longer and more complicated job.

The 6-volt signal lamp of Figure 3 will, however, go out in any case, since it is not connected across the line but is lit by means of the drop through a 4-ohm resistor; and when the series circuit is opened anywhere there is no current in that resistor and no drop across it.

The Circuits of Figure 6

Figure 6 is a circuit similar to Figure 3, but one that has only a single rheostat because it is always used with an 18-volt d. c. generator. The speakers in this case may be wired either in series or in parallel. Two speakers backstage will be wired in series, while four require a series-parallel connection, in which the ammeter will read 3 amperes.

The monitor is in parallel with the line, its current regulated by the W. L. Type "A" 7.4 ohm fixed resistor. This resistor can be fixed because the source is always 18 volts. The 18-volt, 2-candlepower lamp is wired directly across the supply line. The current that lights it does not flow through the ammeter.

Tracing this circuit from the positive input terminal at the left-hand side of the drawing, the line runs to the ammeter positive terminal. From this point a branch circuit runs downward and right to Point 2 of the switch, through the switch bar to the right-hand Point 2, thence down and left through the signal lamp, and left and up to the negative side of the line.

The main positive line continues through the ammeter, then right, down, right, down and right to Lower Point 1 of the switch. Through the switch bar to Upper Point 1, through the rheostat and out to the stage horns. The return is through the negative stage-horn terminal to Lower Point 3 of the switch, through the switch bar to Upper Point 3, then left, down and left to the negative line fuse.

Circuits similar to Figures 3 and 6 are the most common line voltage control arrangements. Figure 1, although used in many theatres, is less frequently encountered.

ADVANCES IN RECORDING, REPRODUCTION CITED BY RCA CHIEF ENGINEER

A RECITAL of the remarkable progress scored in the complex art of bringing realism to sound motion pictures was contained in a series of papers delivered by RCA Photophone research engineers today, before the S. M. P. E. Convention in Hollywood.

Opening the symposium, Max C. Batsel, RCA Photophone engineering chief, traced the history of the development of sound motion pictures in the research laboratories of RCA and its associated companies and pointed out that these pioneers were actuated by fundamental ideals which many studio technicians now neglect because of their absorption with production problems. He told how years of experience in sound picture work had guided the direction of new developments.

The net results are today's highly perfected recording and reproducing devices "which more nearly approximate the engineer's goal of reproducing the original sound so as to effectively produce the illusion of being present at the scenes depicted by the camera."

Mr. Batsel declared that recently developed recording equipment eliminates practically all of the objectionable distortions produced by the mechanical equipment itself. He added that insufficient attention has thus far been paid to the creation of ideal recording acoustics in the studios and ideal reproducing acoustics in the theatres.

Double Theatre System Desirable

For the reproduction of speech in the theatre the auditorium should be free of resonant conditions and appreciable reverberation through the use of sound absorbing materials, he said. Yet these

(*Continued on page 30*)

BRUSHES: THEIR USE AND RELATION TO MOTOR TROUBLE

L. L. Stoffel

PARADOXICALLY enough, troubles which occur from time to time on the brushes of electric motors are in one way a positive advantage, for in most cases these annoying incidents give warning—often long in advance—of deeper-seated troubles in other parts of the machines. By watching brushes closely much trouble can be avoided. Periodical, systematic inspection is the only way to forestall equipment trouble.

When a brush starts to spark, the first step is to examine the brush itself and its immediate surroundings. Are the brushes bedding properly on the commutator or slip-rings? Unless the contact is perfect all over, the brush naturally cannot function properly. If the brush has been recently replaced, has the right kind of brush been used?

There are hundreds of possible combinations of resistance, hardness, abrasiveness, contact-drop qualities, and grades of material. These brush properties are really a part of the design of the machine. Even a much more costly brush may be less suitable than that recommended by the makers of the motor. And it by no means follows that because a brush happens to fit the brush-holder it will function correctly.

Excessive Sparking

If sparking persists after checking the foregoing, see if the brush is worn down too far for the tension spring to keep it in proper contact. Brushes which are too short (especially if they are also somewhat too loose in the "box" of the holders) are apt to chatter and spark. In extreme cases, they may even break or slip from under the "box-holder"—generally with disastrous results to the motor itself.

Next: is the brush free, but not too free, to feed forward in its holder? "Stuck" brushes are a frequent cause of sparking and of ultimate destructiveness to the surface on which they run. Dirt, corrosion due to chemical fumes, and brushes the sides of which are not parallel, are the principal causes of the jamming of brushes.

Next try adjusting the tension spring on the hammer which presses the brush against the commutator or ring. If the pressure is insufficient, the brush will spark and chatter. If too much pressure is used, the sparking may decrease, but the brush will get hot and wear quickly.

Where the motor is exposed to much dirt or corrosion, it may not be possible to cure the sparking entirely by the methods previously cited, or by others detailed subsequently. In such a case, get in touch with the makers of the motor (or with a brush manufacturer) relative to using a type of brush with greater abrasiveness so as to keep the metal-collecting surface clean.

Such changes should not be made haphazardly. Moreover, the new brushes should not be tested by running them together with the old brushes, for if the resistances of the two sets are different one set may "hog" the load, thus making the "test" worse than useless.

Check Pigtail Connections

Next, check up the pigtail connections which furnish a path for the current from holder to brush in most motors. Are they unbroken? Are they properly secured to the brush and holder? If not, the current must pass through the hammer and tension spring, and through the sliding contact between brush and metal holder surface. "Pitting," burning and arcing will then make short work of these.

Are the connections between brush spindles and their cables tight? If not, one or more sets of brushes will have to carry more than their share of current, and will almost certainly spark excessively. The trouble will be on the set which does NOT spark, of course.

Are the brush spindles loose in their bushings? Are they parallel with the commutator or ring surface? Are they also parallel with the slots in the commutator (if the machine be a commutator type)? Are the brushes properly spaced around the commutator or rings? This is much more important in the case of a commutator machine than in one with slip rings.

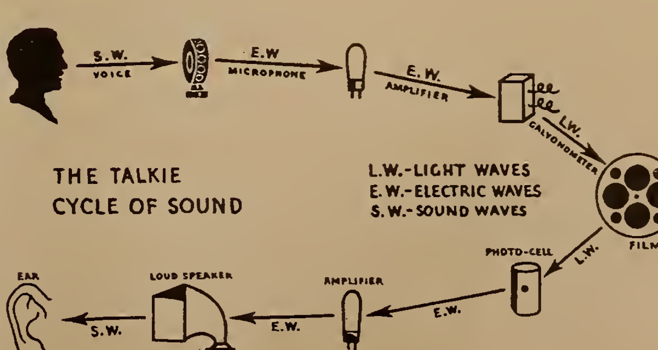
If the brush rocker is adjustable, does it hold the brush system as a whole in its right position as to the proper collecting points? Modern interpole machines are extremely sensitive to wrong position of even single brushes. Is the brush rocker clamped tight so that it cannot shift around?

Testing for Overheating

Does the sparking still persist? If the machinery driven by the motor has recently been rearranged or added to, test the load. TEST—don't guess. If this is the trouble, the motor armature will be hot all over, concurrently with the sparking. Test for the temperature rise above that of the surrounding air. Most motors are rated to operate on full load with a rise of 50 degrees Centigrade; though some are rated for 40 degrees only. Pack the thermometer directly in contact with the overheated part, covering it with tightly packed rags, so that the cooling effect of the surrounding air will not falsify the reading. Allow a few minutes for the thermometer to reach its maximum reading.

If no thermometer is handy, and you use the rough test of noting if the armature is too hot to bear the hand on it for a few seconds, remember to feel the windings—not the metal. Metal always feels much hotter than it actually is.

If the measured load is not excessive,



Simple representation of the sound picture process — studio to theatre—used in popular magazine stories on the art

yet the motor armature still heats badly, look for troubles in the motor itself. Bearings may be too tight or may need oil, or the oil rings may not be working. Dirt may be wedged in the housing, between the poles, or in the air gap.

Does the commutator or ring look burnt in places? See if the brushes rise and fall slightly when the armature is rotated slowly. The commutator or ring may be "out-of-round." Are any wearing down faster than others?

Are the mica insulation divisions between the commutator bars projecting slightly above the metal? If the mica has been "undercut" below the level of the bars to avoid this trouble, the slots may have been filled up with dirt, dust or oil. Is the metal of the rings softer in some parts than in others? Are rings or commutator "gummy" or dirty?

Short-Circuited Winding Coil

Bad sparking and flashing, combined with only part of the armature getting hot, suggest a short-circuited coil in the winding. The same symptoms, but with all parts of the armature equally hot, suggest unequal air-gaps between poles and armature; or between stator and rotor in an a. c. machine.

In both types of mot r the current will rise; and in an a. c. induction motor (g nerally used in mills and factories) this current will be unequal in the different phase winding. The usual cause of the trouble is, of course, worn bearings; but another cause may be that the poles were originally adjusted to final air-gap accuracy by means of thin shims placed at the back of the poles, and that in reassembling these have been omitted or have slipped out when the poles were bolted up in place.

Bad contacts or broken wires between coils and commutator show up by violent flashing at the broken points (often becoming a ring of flame around the commutator) though there may be little heating in the windings in general.

Speed and Load Considerations

If the speed of a d. c. motor is too high on no load, and the machine also refuses to start under load and blows its fuse, a weak field is indicated. If recently disassembled, there may be a reversed field connection, a partial short-circuit in one or more field coils, or trouble in the starter.

In an a. c. induction motor, look for a short-circuit or break in one of the phase windings of the rotor or stator. In an induction motor, however, the no load speed will not be too high (wound rotor type motor). Before checking the phase windings, see if one fuse is blown. A blown fuse may allow an already-started polyphase motor to continue to run on the other phases, but at a high current. Note that if one field in a d. c. motor be short-circuited, the resultant electrical unbalance will cause sparking on the set of brushes under its influence.

Sparking troubles due to grounds are not included, mainly because the only way to detect them far enough ahead is by proper measuring instruments in the hands of a skilled repairman. Also, when a "ground" has got to the stage where it is obvious to ordinary inspection, it is generally too late to do much about it.

Sharp Division of Craft Opinion on I. P. Print Footage Publication

THAT there exists a sharp division of opinion among projectionists as to the desirability of publishing footage numbers in these columns is disclosed by the deluge of opinions received in answer to our query of last month. Many and varied are the reasons advanced in support of both sides of the question.

The most important objection voiced by those on the negative side of the discussion is that footage figures as released by the distributors are invariably incorrect, several readers citing variances as great as ten minutes. Then there is the question of censorship cuts which in some states render worse than useless any published figures.

Typical opinions follow:

I am opposed to I. P. printing film footages. Such figures as are now published in exhibitor trade journals are as much as ten minutes off in many cases. I am thinking, too, of all the I. P. space these footages would require, to no good purpose.

Let's all follow the suggestion made by Max Bentzman in your April issue which, if followed by the craft, would be much better and would save the space in I. P. for the more important material you are now presenting.

C. T. JOHNSON
Lockport, N. Y.

I am a projectionist in a third-run house and have to do a lot of guessing about footages. I recommend publication of feature footages, at least, in I. P.

ROY BEAL
Fort Wayne, Indiana

Register me as emphatically opposed to publication of footage figures in I. P. Correct figures would be impossible to obtain and would only cause more confusion.

S. COOLEY
Manchester, N. H.

Mr. Bentzman suggested that, prior to shipment, all projectionists mark the footage numbers, as they found them, on the reel bands of all subjects, features and shorts. Objection to this suggestion has been voiced on the ground that if the reels are returned to exchanges before reaching the subsequent-run theatre, there is small chance that the markings, even if they are not obliterated, will be correct.

Other representative opinions follow:

I think that publication of running time in I. P. is a great idea. The running times now published in other papers (which seldom reach the projection room, anyhow) are always incorrect and lead us all astray. I have to estimate the running time on all subjects coming in, and as we use a double-feature program, the difficulties are apparent.

The ideal system, of course, would be for the exchanges to clock footages after each run, and then to mark the footage plainly on the band before the next shipment. But will they? I think not.

This Local will gladly cooperate with you and the field in any plan adopted.

DEAN W. MOREHOUSE
Secretary, Local 338
Watertown, N. Y.

. . . We should like to cast our vote as a unit in favor of I. P. printing the footage lengths of current features and short subjects.

ERNEST E. CASSIN
Secretary, Local 622
Port Huron, Mich.

Probably the most desirable way of solving this problem is to work it out not on a national but on a state-wide basis. The clue to such a plan is contained in the following interesting communication which not only presents a very worth while idea but also reveals the existence of that which most readers consider impossible to attain—cooperation with other state units:

Knowing that exchanges have done nothing to date in marking running times on features and short subject reel bands, the undersigned and Mr. Francis Hill, projectionist of the Florida Theatre here, have had made to our order a rubber stamp which we use on all releases—features, shorts, news, etc. The stamp reads as follows:

Running Time——Minutes

Pheil Theatre, St. Petersburg, Fla.

FERNANDEZ & BARHYDT,

Projectionists I.A.T.S.E. 552

We have succeeded in interesting several other Florida Locals in the plan, and it is working out fine, with almost every show that comes in now having distinct footage markings on the bands.

I don't know whether we projectionists are running ahead of ourselves in this matter, as I still believe that this is a job for the exchanges. In view of exchange delinquency, however, we Florida projectionists have followed the aforementioned routine, and it has helped tremendously.

As for the censorship angle mentioned in I. P., once the Florida State Board has passed a given picture there is nothing to worry about from this angle. The running time as marked on the bands works

(Continued on next page, Col. 1)

TELEVISION, COLOR FILM FEATURE

S. M. P. E. COAST MEETING

MOST successful in every respect—papers program, attendance, locale and sustained interest on the part of the delegates—was the recently-concluded Convention of the Society of Motion Picture Engineers, held in Hollywood, Calif., May 20-24. Delegates from many foreign countries helped to swell the attendance to well over the 350 mark.

The papers program was the most varied and interesting one that has been presented by the Society in several years. Production problems received considerable attention, as was natural considering the convention city, and all agreed that the gathering augured well for a continuation and extension of the friendly relations existing between the Society and the Academy of M. P. Arts & Sciences.

So successful was this first West Coast meeting of the general Society, in fact, that it was voted to award the Society Convention to Hollywood every other year hereafter, beginning with the Spring meeting in 1937.

Unquestionably the outstanding paper of popular appeal was the contribution of Dr. A. N. Goldsmith entitled "Television and Motion Pictures," which is a highly successful attempt to analyze the relation of this new art to, and its ultimate general effect upon, motion picture theatres of today. This paper appears elsewhere in this issue.

Another convention occurrence of particular interest to I. P. readers was an address by International President George E. Browne of the Alliance to the get-together luncheon which opened the convention. President Browne being detained in New York on urgent organization business, his address was read to the Society by Thad C. Barrows, president of I. A. Local 182, Boston, a delegate to the meeting.

I. A. Pres. Browne's Address

President Browne's address, published in full elsewhere in these columns, stressed the importance of a closer tie between the studio and theatre workers and the engineers, considered existing relations in the light of past experiences, urged a mutual respect by each group for the rights of the other, cited the theatre as the domain of the craftsman and the laboratory as the province of the engineer, and pledged every aid in his official capacity as Alliance leader to the cause of better craftsmanship.

Also of particular interest to the craft on the papers program, a partial list of which is appended hereto, was the report of the Projection Practice Committee, which consisted of a complete revision of plans for an ideal projection room layout. This report is of great significance and importance to the craft since it embodies recommendations of construction details for which the craft generally has been campaigning for years in the interest of health and safety, in addition to permitting production of a better show.

Among the sectional headings of this report, attesting to its great value, are the following: Floor, Ceiling, Walls, Ports, Noise Muffler, Painting, Lighting, Ventilation, Spacing, Master Signal System, Fire Shutters, and Exhaust Fan. The Society will endeavor to obtain the widest possible circulation of this report, which sustains this particular Committee's reputation for splendid contributions to the literature.

The Projection Screen Brightness Committee, which has been considering improvement of screen lighting, will enlist the aid of various colleges in determining the most generally satisfactory level of screen brightness for an auditorium of given dimensions.

Representatives of the 16 mm. projector manufacturers urged the Society to give close attention to the possibilities of substituting 16 mm. projection equipment in many theatres of small and medium size as a means of reducing expenses without sacrificing quality. The small-film advocates cited several alleged advantages of 16 mm. equipment, included among which was the fact that non-inflammable film may be used.

The contributions on color film proved disappointing to many delegates in that they were more concerned with the artistic phase of the subject than with the details of technique and expenses, the latter rating first importance in many quarters of the industry. The forthcoming Radio Pictures release, "Becky Sharp," was held to be the forerunner of a sudden splurge in color production, although no reference was made to the fact that the negative costs alone thereon mounted to $1,200,000.

Announcement was made that S. M. P. E. 16 mm. standards, providing for, among other things, one row of sprocket holes and the positioning of the sound track on the other side of the film (viewed from the emulsion side), where the second row of sprocket holes ordinarily be, have been accepted by the American Standards Association. Serious differences of opinion on this standard exist between American and European manufacturers.

'Hard' vs. 'Soft' Lighting

National Carbon Co. marshalled an imposing array of data in support of its contention of long standing that "hard," or carbon, lighting is the only means for properly lighting a motion picture set. With the advent of color, insists National, the superiority of carbon arcs will be definitely established.

RCA technicians discussed and demonstrated the new RCA High Fidelity system of sound-on-film recording which, confirming the opinion of this writer after a private preview in New York, elicited outspoken admiration among convention delegates. This process is discussed in detail in this issue.

Helping considerably to round out the Convention program was an unusually interesting exhibit of apparatus, a varied social program which included group trips to the various studios, and (intimidated by the Southern California Chamber of Commerce as we are) the gorgeous setting for all activities.

Among the papers of especial interest to projectionists were the following:

"Television and Motion Pictures", Dr. A. N. Goldsmith.

"Some Background Considerations of Sound System Service", J. S. Ward, Erpi.

"Modern Methods of Servicing Sound Motion Picture Equipment", C. C. Aiken, RCA Manufacturing Co.

"The Technicolor Process", J. A. Ball.

Report of the Projection Practice Committee, J. O. Baker, *Chairman*.

Report of the Projection Screen Brightness Committee, C. Tuttle, *Chairman*.

"The Relation between Projector Illumination

(*Continued on next page, Col. 1*)

Print Footage Publication

out correctly, always provided, of course, that the projector motors run at the correct speed of 90 feet per minute.

CECIL FERNANDEZ
St. Petersburg, Fla.

On the basis of comment received to date, I. P. is of the opinion that the publication of footage figures in these columns, while possibly of occasional help, would fail to meet the exigencies of the situation and would not justify the space devoted thereto. It must be admitted that no figures at all are eminently preferable to incorrect figures, the bulk of craft opinion being that all published footage figures vary considerably.

'Cooperation' Improbable

While the state-wide idea cited by Mr. Fernandez has distinct favorable possibilities, the plan as a whole is another one of those "cooperative" measures that can not be said to have met with much success in the past.

Data relative to the situation will be presented by I. P. to the next meeting of the Exchange Practice Committee of the S. M. P. E. in the hope that, with the aid already promised by the Hays organization, some practicable plan can be worked out.

Questions and *Answers* on Sound Projection

Aaron Nadell

Note: This department is launched in response to numerous requests by readers for such a service. The worth of this section, which will be a monthly feature, depends wholly upon the cooperation given by readers: the more numerous the inquiries, the more varied the department and the greater its value. Correspondents are requested to be specific and as brief as possible. Only initials will be appended to questions.—EDITOR.

Q. In your article you mention an "audio oscillator" for testing and comparing amplifiers with which I agree, but where can a satisfactory oscillator circuit be obtained with which to build such an audio oscillator? Too much depression for me to buy such as . . . and I must be content to construct one. I have searched several amplifier texts for a circuit and given up in despair.

E. W. McG., Utah

A. Sorry; but I.P. believes that not only will you find an oscillator cheaper to buy than to build, but the whole practice of the construction of sub-standard and doubtful apparatus by projectionists or others not equipped to test their results is poor policy.

Suppose you had the circuit and had built the oscillator, how would you know it was accurate enough for use without sending it for calibration to the Bureau of Standards or an electrical testing laboratory, either of which would charge you a substantial fee? And if they found it working improperly, you would have to rebuild and pay another test fee. You can probably rent a calibrated oscillator, if you need one, from some radio repair shop in your city. For all ordinary work test loops, test film and test records should prove sufficient.

Q. I am constructing a microphone amplifier suitable for a two-button mike to be used with the installation in this theatre. Would appreciate it if you would send me a schematic diagram of a good two-stage amplifier suitable for this type of equipment.

R. A. P., Georgia.

A. A double-button carbon mike working into the system amplifiers you mention will not need a pre-amplifier. All you need is a microphone transformer to switch to your amplifier input, which in your case is probably 250 ohms.

Q. My amplifier is a Radiart, last stage using two 47's in push-pull. I note a better sound quality when I can increase the volume control on account of increased audience. Could I use two 59's and adapters without other changes, instead of 47's, and so use a little more of the current from the photo-cell and lower stage tubes?

W. H., Illinois.

A. These tubes do not have the same characteristics. The last stage of your amplifier would have to be re-wired. I. P. feels it is not good policy to make such changes without full equipment for testing the results.

Are you sure the fault lies in your amplifier? There seems to be a possibility that the auditorium is too reverberant, and that the addition of an audience provides sound absorption that improves the quality.

Q. Any information as to where an analyzer for testing sound equipment can be purchased and the approximate cost of same will be appreciated. Also interested in the same information about a good output meter.

R. M., Penna.

A. Your name will be forwarded to the manufacturers and supply companies concerned.

Q. In the March issue you recommend an analyzer, output meter, sound and visual test reel, film loops. As I am servicing nine theatres . . . please refer this to the makers of the above mentioned equipment. Also would like to have the names of some manufacturers of parts and supplies for W. E. equipment.

J. B., Oklahoma.

A. Your name will be forwarded to the manufacturers and supply companies concerned. The sound and visual test reel can be obtained from the Society of Motion Picture Engineers, Hotel Pennsylvania, New York.

Q. I desire information as to where or of whom I may be able to purchase an analyzer. . . . I am under the impression there are five meters of different types, also space for testing tubes, all on one panel.

W. W. J., Texas.

A. Analyzers differ in construction. The more modern types usually mount only one or two meters, which can be used for many different purposes, such as reading voltage, current or resistance, a.c. or d.c., by changing switch settings on the panel. The panel may contain a number of sockets for testing different types of tubes, or only a single socket, in which all tubes are tested by means of adapters. Your name will be forwarded to the manufacturers concerned.

Wide Range Analysis

Q. I would appreciate it if in future issues you can publish an analysis of the network used for wide range in Erpi systems. Why is the 250-ohm output of the amplifier used instead of 500-ohm output? Also an efficient method to test for continuity without upsetting the magnetic characteristics in audio transformers and voice coils.

A. D., Penna.

A. An analysis of the wide range speaker system is scheduled for an early issue. You can test continuity coils with good headphones, of approximately 1,000 ohms per receiver, and a B or C battery. A good quality, high-resistance voltmeter or ohmmeter can also be used. None of these instruments will pass enough current to do damage.

Q. May both types of photo-cells (vacuum type and gas-filled type) be used in sound-on-film equipment? Do the two types have different operating characteristics?

H. W. W., Ohio.

A. Both types have been used. Operating characteristics differ slightly, chiefly in that the plate current of the gas-filled type is higher and the volume drawn from it therefore greater. Plate voltages are likely to be identical, although on this point you must consult the manufacturers of the particular cells you have in mind. With similar plate voltages little or no modification is necessary to substitute one for the other.

You do not mention the type of equipment in which you wish to use these cells.

and Screen Size", D. Lyman, Eastman Kodak.
"The Photoelectric Cell and Its Use in Sound Motion Pictures", M. F. Jameson, Bell Telephone Laboratories.
"The Radiant Energy Delivered on Motion Picture Sets from Carbon Arc Studio Light Sources", F. T. Bowditch and A. C. Downes, National Carbon Co.
"The Photographic Effectiveness of Carbon Arc Studio Light Sources", F. T. Bowditch and A. C. Downes, National Carbon Co.
"Lighting for Technicolor Motion Pictures", C. W. Handley, National Carbon Co.
"A New Wide-Range Spot Lamp", E. C. Richardson, Mole-Richardson, Inc.
"Sources of Direct Current for Non-Rotating High-Intensity Reflector Arc Lamps", C. C. Dash, Hertner Electric Co.
Interim Reports of Academy Committees on the Release Print and Screen Brightness, G. S. Mitchell, *Manager,* Research Council, Academy of Motion Picture Arts and Sciences.
"Wide-Range Reproduction in Theaters", J. P. Maxfield and C. Flannagan, Erpi.
"The Projection Background Process", F. Jackman, Warners.
"Technical Considerations of the High-Fidelity Reproducer", E. D. Cook, RCA.
"Development and Design of the High-Fidelity Reproducer", F. J. Loomis and E. W. Reynolds, RCA.
"Technical Aspects of the Motion Picture", A. N. Goldsmith.
"The Contribution of Dr. Lee deForest to the Electronic and Motion Picture Arts", G. A. Chambers, Eastman Kodak.
"The History of the Talking Picture", W. E. Theisen.
"Recording Music for Motion Pictures", M. C. Batsel, RCA.
"Analysis of the Distortion Resulting from Sprocket-Hole Modulation", E. W. Kellogg, RCA.
"A Comparison of Variable-Density and Variable-Width Sound Records", E. W. Kellogg, RCA.

Television and the Motion Picture Theatre

★ **Originally presented before the S.M.P.E., this paper is the first basic contribution to the literature of the television art and promises to be of historical importance**

By A. N. Goldsmith

PAST-PRESIDENT, SOCIETY OF MOTION PICTURE ENGINEERS
PAST-PRESIDENT, INSTITUTE OF RADIO ENGINEERS

IT MUST be admitted that the relationship between motion pictures and television has, in the past few years, been made the subject of numerous effusions which, even from a charitable viewpoint, must be characterized as highly imaginative and distinctly misleading. It is unfortunate that the present and future correlation of these important fields should have been made the subject of casual publicity releases or of selfishly inspired propaganda.

The subject is of considerable importance and merits thoughtful and impartial analysis. Such analysis requires, it is apparent, an unusually complete knowledge of the commercial activities and engineering methods of the two fields which are involved and perhaps something of a gift of prophecy as well. It is proposed in the following:

(*a*) to consider the methods likely to be used in television-telephone broadcasting into the home;

(*b*) to compare the results likely to be achieved by television-telephone broadcasts into the home with those obtainable by theatrical sound motion pictures;

(*c*) to consider the probable points of contacts between these fields, and to explore the possibilities of cooperative effort between them; and

(*d*) to consider the possible general effects of the widespread acceptance of television-telephone broadcasting into the home on the motion picture theatre.

A Definition of Terms

In studying (*a*), the first of these topics, it is necessary to adopt some standard for "television"—a term having widely different meanings to various people. It is proposed to accept "standards" which represent what may reasonably be expected to be attained on a large scale within the next few years, provided mass production of equipment for television-telephone broadcasting reception in the home is carried out.

The term "television-telephone broadcasting" is used because it is naturally assumed that the television picture will be consistently accompanied by the corresponding sound or telephonic material. While some of the details of home television-telephone reception will be given under the study of topic (*b*) below, it may be postulated here that such television will be accomplished by the use of:

1. an electronic pick-up rather than by a mechanico-optical pick-up. (Such pick-ups include the iconoscope and the dissector tube);

2. an ultra-short wave transmitter or transmitters for the television and telephone portions of the program;

3. an coaxial-conductor cable, or its equivalent, or an ultra-short wave radio relay system, for the syndication of the program material for network operation, and

4. an electronic receiver of the cathode-ray type, with a fluorescent image screen, rather than a mechanico-optical receiving system. It is impracticable within the limits of this paper to discuss the principles, design, construction or operation of the complicated devices mentioned above.

Home Television vs. Motion Pictures in the Theatre

Proceeding to the study of topic (*b*), there will be given an itemized and instructive comparison of the practical results to be expected by home television-telephone reception as compared with the motion picture theatre performance.

1. *Mode of Picture Production.* The methods of producing the pictures are entirely different in the two cases, odd as that may seem. The theatre picture is projected as a complete unit, one entire frame at a time. The delineation is produced and limited by aggregates of silver grains in the developed positive image. The television picture is produced by a luminous dot (or "dot-element"), the brightness of which is accurately controlled as it passes in succession over a series of parallel and closely adjacent lines until it has covered the entire area of one frame.

In the theatre case, the entire picture is on the screen at the same time, to be succeeded by darkness prior to the projection of the next frame, and so on. In the television case, there is never anything more than a more or less bright dot on the screen!! The television picture depends even more on persistence of vision than the theatre picture, being in fact nothing more than a flickering and flying dot.

It must be added that certain technical details of television picture production have not as yet been standardized. However, the above-cited features appear likely to be permanently present.

2. *Number of Picture Elements.* The number of picture elements determines the detail or, roughly, the story-telling capabilities of the picture. In round numbers, the theatre picture has something of the order of 5,000,000 picture elements; whereas even a good home television picture will probably have something like 150,000 elements. This is a ratio of 30-to-1 in favor of the theatre picture. However, it must be noted that the entertainment value of a picture in motion (whether produced by projection or by television) is not in direct proportion to the number of picture elements which it contains, so that we are not entitled to draw the conclu-

sion that theatre pictures, though more detailed in structure, are necessarily far more entertaining (particularly on the small home screen) than television pictures. Probably a television picture in the home will be described by most as a "fair home movie."

3. *Grain or Line Structure.* Theatre pictures of reasonable size from a suitable positive show negligible grain if viewed at moderate and practicable distances, and of course show no line structure (for monochrome pictures). Television pictures show no grain structure, but may show a slight line structure if viewed too closely. However, high-detail television pictures, viewed at normally comfortable distances, will show practically no line structure—and certainly no objectionable line structure.

4. *Color of the Picture.* Theatre pictures are normally black in the shadows and white (blue-white or yellow-white) in the highlights. When projected from toned or tinted positives, they show the corresponding hue. Television pictures are also practically black in the shadows, but the highlights may be bright yellow, greenish yellow, or even a practically neutral white. The latter color will probably become common practice in television as development of that art proceeds.

5. *Possibility of Full-Color Pictures.* It is readily possible today to produce theatre pictures which show substantially the colors of nature or, at least, an acceptable approximation thereto, although there are definite economic handicaps in production and reproduction of such pictures. Television in full-colors seems to be an almost impracticable proposition in the present or likely early state of that art, although small-scale demonstrations of its abstract possibility have indeed been given.

Comparative Picture Size

6. *Size of the Picture.* Theatre pictures range in size from, say, 6 to 8 feet to perhaps 18 by 24 feet, or even more in special cases. Thus their area is between 48 and 432 square feet. Home television pictures range from about 6 by 8 *inches* to perhaps 18 by 24 inches, or, in special cases, somewhat more (though generally at the cost of picture detail and brightness). Thus their area lies between about 0.3 and 3 square feet.

On this basis the area of the theatre picture is about 150 times that of the home television picture. A more normal comparison would be with the approximate 30-by-40 inch *home* motion picture, having an area of about 8 square feet, or say about 5 times that of the average television picture.

7. *Picture Brightness.* Theatre pictures are generally adequately bright for viewing in a darkened auditorium (that is, an auditorium with illumination about 0.5 foot-candle). The television pictures are also sufficiently bright to be viewed in a dimly lit room—but dark shades will be required for daylight hours, and for the evening as well, if street lighting is at all bright outside the home.

8. *Flicker of the Picture.* The theatre picture consists of 24 frames per second, each of which is generally projected twice before the next frame reaches the screen. Flicker is absent, although traces of an effect depending on picture sequence are still found in the case of rapidly moving objects and in the stroboscopic backward-turning of the wheels of pictured vehicles.

Television pictures may be projected in two sets of 30 pictures each, the two sets being projected in 1 second. Interlaced scanning may be used, and under these conditions a substantially flickerless picture is obtained. Despite the projection of 60 half-detail pictures per second by this method (equivalent closely to 30 full-detail pictures per second), it is possible to use ordinary 24-frame-per-second motion picture film for the television subject without undue difficulty by the use of technical expedients which cannot be here described.

Viewing Distance; Audience Size

9. *Viewing Distance.* Taking an optimum viewing distance of 4.5 or 5 times the picture diagonal, theatre pictures may be most conveniently viewed at from 45 to 135 feet from the screen, while home television pictures will be viewed from about 4 to 11 feet from the screen. This is a ratio of viewing distances of about 11-to-1 in the two cases.

10. *Audience Size.* Long experience has demonstrated that the comfortable size for theatre audiences ranges from 500 to 5,000 persons, with perhaps some doubt at one extreme or the other. The corresponding home audience may be expected to lie between 3 and 15 persons, a ratio in favor of the theatre of about 200-to-1. It must not be inferred, however, that the economic ratio for the two fields is anything like as high as this; indeed it has not yet been determined just what will be the cost per person per hour of entertainment for home television-telephone broadcasting.

11. *Synchronism of Picture with Sound.* In the theatre, the picture and sound are correctly associated within 1/24th of a second, assuming proper editing and threading. In the case of home television-telephone programs, the synchronism is even closer (though this is not noticeable as an advantage), and is entirely correct and automatic. Some rather romantic writers on this subject have dilated on the "marvel" of the synchronism of picture and sound in such programs. As a matter of fact, considering the fundamentals of the processes employed, it would be even more marvelous if synchronism were not obtained for television-telephone broadcasting reception.

It is not practicable at this time, before mass production of television equipment has been initiated, to give a reliable comparison of the cost of theatre and home equipment. In a general way it may be said that theatre equipment costs in the *thousands* of dollars and home equipment about the same number of *hundreds* of dollars, thus giving a cost ratio of perhaps 10-to-1. Here again some caution must be used in interpret-

(*Continued on page* 27)

Dr. Goldsmith on Television—

The relationship between motion pictures and television has . . . been made the subject of numerous effusions which, even from a charitable viewpoint, must be characterized as highly imaginative and distinctly misleading.

The television picture depends even more on persistence of vision than the theatre picture, being in fact nothing more than a flickering and flying dot!

Television in full-colors seems to be an almost impracticable proposition in the present or likely early state of the art . . .

Thus their area (television pictures) lies between about 0.3 and 3 square feet.

. . . the theatre has a number of definite and inherent advantages as a showplace.

People are interested in change (from the home). . . . also, people are gregarious and somehow seem to have their emotional responses enhanced by crowd enthusiasm.

. . . the theatre need not be unduly apprehensive over the advent of television.

. . . given its natural advantages, a forward-looking attitude, real initiative and careful planning, there appears to be little doubt that the motion picture theatre can hold an enviable position of public acceptance and resulting prosperity in the future . . .

The IP EDITORIAL PAGE

Vol. 8, No. 5 MAY 1935

Television and The Motion Picture Theatre

Dr. A. N. Goldsmith's paper on television and its relation to the future of the motion picture theatre, appearing in this issue, is a basic contribution to the literature of the art and, we think, one that will be of historical importance. The good doctor is twice blessed in that he is not only one of the world's outstanding technicians but is also capable of discussing the economics of a given situation with the best of them.

We advise careful reading of this paper—and a re-reading. Its technical data is unquestionably accurate, and its conclusions the product of the highly analytical and logical mind which his intimates know that Dr. Goldsmith possesses. Reflecting serious concern on the score of the buffeting to which television has been subjected by the pseudo scientists, the blatant and publicity-at-all-costs Hollywood producers, and the inevitable self-seeking promoters who hang on the fringe of every development, Dr. Goldsmith's paper is, in effect, a highly successful effort to lift this erstwhile prostitute of the arts from the gutter and endow it with sufficient self-respect and dignity to enable its admittance on at least a novitiate basis to the society of the other electronic arts.

The paper carries a forceful warning to the motion picture industry, serving notice that its house must be put in order through badly needed renovating in corners where most needed, and it indirectly administers a spanking to the die-hard stand-patters who think of the business today in terms of 1910. The answers to most of the television-vs.-motion pictures questions are there for all who trouble to digest Dr. Goldsmith's article—including Labor.

Summed up, the paper states that motion pictures have little, if anything, to fear from the advent of television, even on a large country-wide network basis—provided the picture industry prepares now to put its affairs in order. In support of this premise the paper delivers telling blows—reasons technical, economic, and psychological.

This paper is, we think, the most important we have ever been privileged to present. Give it your closest attention.

A Temple of Deceit

A divorce court, it has been well said, is a temple where liars go to pray, but this statement should be expanded to include courtrooms wherein are heard patent cases and actions relating to restraint of trade, such as have been on view in the sound picture field for several years past. A case in point is the current action in Wilmington in which Duovac and General Talking Pictures Co. are seeking relief from the alleged monopolistic practices of Erpi. The latter, having settled three millions of dollars upon Warners, originally a party to the action, understandably has no desire to unload like sums upon the remaining plaintiffs.

Some of the Wilmington testimony is pretty raw, even for this type action, according to our viewpoint. For instance, a former employee of Duovac testified that this company's types 242 and 864 tubes were exact copies of Erpi tubes.

What are the facts? The record, as we read it, shows that the Duovac 242 tube was used to replace many Erpi 211 tubes for months prior to any move by the latter to produce a 242 tube. We also see it that the Duovac 864 tube was introduced to the sound picture field some six months before Erpi brought out its 264 type.

These are just two items from testimony that we think contains some of the fanciest lying displayed in this or any other court. Admittedly the stakes in the Wilmington tussle are high; yet it takes considerably more courage than we possess to spill such testimony under oath in the face of the known facts. Such goings-on are just another tribute to the high-mindedness characterizing business in the sound picture field and the lofty level upon which it is conducted.

By the way, has anybody heard the story of how a group of engineers possessing bags of emery destined to be deposited in the gear train of a rival company's equipment, were chased across several theatre roofs? This makes for even better reading than does the daily work report on the Temple of Lies now being erected in Wilmington.

Secrecy on Sound Equipments

We have been considerably annoyed of late by the refusal of certain manufacturers to supply information relative to their sound equipments which has been requested by our readers. Now, there is nothing mysterious about theatre sound equipment in the year 1935, and the battle on this issue of secrecy was fought out years ago with both Erpi and RCA, the results thereof being very discomforting to these companies and harmful to their public relations.

Manufacturers should adopt the view that anything—schematics, instructions or advice—calculated to improve the performance of their equipments in the field contributes to successful operation and makes for a satisfied customer. Recognizing the wisdom of such a policy, some manufacturers supply schematics of every unit of their equipments, to their ultimate profit.

As a statement of policy, when this publication desires information on any equipment for its readers, it is determined to get it. Failing this, it will publish a list of manufacturers who withhold such information and will advise its readers to refrain from patronizing such firms. We would prefer not to follow this course, but follow it we shall if the manufacturers in question don't abandon these antiquated notions of doing business.

Otterson for President

The name of John E. Otterson, president of Erpi, has been bandied around in the public and trade press for weeks now as a 100-to-1 shot to be jammed through, by those who usually control big-company reorganizations, as the next president of Paramount. Conspicuously lacking is any denial of this story from Otterson, or Erpi or A. T. & T., all three of whom, judging from past performances, might be expected to work up a fine froth anent such stories flooding the press. With a heigh-ho and a ho-hum we have two observations to make: (1) the aforementioned report is strangely coupled in our mind with a bombproof cellar, and (2) business must be positively booming at Erpi.

CRAFT-ENGINEER RELATIONS CITED BY I. A. PRESIDENT BROWNE TO S. M. P. E.

Appended hereto is the complete text of the address by President George E. Browne of the I. A. to the recent Convention of the S. M. P. E. in Hollywood. The address is significant in that it marked the first time that a representative of organized Labor had been invited as such to address the Society, and also because it forecasts closer relations between the engineers and other workers in the field.

President Browne also made several pertinent remarks anent the domains of engineer and craftsman and voiced the hope that neither group would ever intrude upon the domain of the other. President Browne being detained in New York on urgent organization business, his address was delivered to the Society by Thad C. Barrows, president of Boston Local 182 *and a member of the Society.*—Editor.

I WELCOME the opportunity accorded me, as a representative of the organized craftsmen in the motion picture industry, to address this gathering of members and friends of the Society of Motion Picture Engineers. Both the Society and the International Alliance have compiled imposing records of achievement in this field, and it seems to me fitting that some outward expression be given to the bonds which undoubtedly exist today between our two organizations.

Obviously, the progress of both groups must necessarily parallel the progress of the industry of which we are a part, and it is precisely for this reason that I cite the urgent need for a common understanding of the aims of each other.

Vastly Improved Relations

I disclose no secret when I say that in the not too distant past the relations existing between engineers and other studio and theatre workers certainly left a great deal to be desired. This situation had its roots, I believe, in an almost complete lack of understanding on the part of both groups as to the place occupied and the rights enjoyed by each other.

Happily, this problem—and a serious problem it was, too—has been overcome; it succumbed, so to speak, to the pressing need for results, *good* results, in both studios and theatres. A most important contribution to the creation of a better feeling between our groups was made by those members of the Alliance who, through long experience and unselfish devotion to the art, aided tremendously in the practical application of the engineers' work in laboratories.

I cite as one example the Projection Practice Committee of your Society, which, I understand, has done consistently fine work for several years past and is generally regarded by the Society as one of its most valuable arms. The Alliance is proud to have generous representation on this Committee; and this work of several outstanding Alliance craftsmen, and their close contact with you engineers, certainly exerted a potent influence in fostering a feeling of goodwill and mutual respect on the part of both organizations.

As you all know, the primary concern of the Alliance—in fact, its very reason for being—is to advance the interests of its members through obtaining and maintaining wages and working conditions. Yet, it need not be inferred from this statement that the Alliance is unmindful of the benefits which accrue to it from superior craftsmanship, through a job well done by its members. On this point alone there certainly exists a mutuality of interests between the Society and the Alliance.

As a matter of hard cold fact, the Society and the Alliance are much more closely tied together by a knot of mutual dependence. How many of us ever stop to realize that representatives of our two groups see a given piece of equipment right through its entire life from the time of its design to the time when it has served its purpose and is replaced by new and better equipment?

You engineers who conceive, design and build an equipment are almost wholly dependent for good results upon we who install, operate and maintain that equipment. From you, the engineers, come marvelous new devices which enable us to deliver better results; and from the projection room back to the laboratory there runs an invisible but none the less well-defined path over which travel the findings of the practical man who uses your equipments.

Certainly it is to the advantage of both our organizations to do everything in our power to so broaden and smooth this path that it will become a highway over which will be sent the best contributions to the art from both groups.

Mutual Recognition of Rights

In our progress toward this ideal relationship we must never overlook the vital necessity for mutual recognition of each other's rights. The laboratory is the domain of the engineer and there he is in supreme command. His task it is to design, to experiment, and to manufacture, assemble and test equipments.

Subsequently the equipment is installed in a theatre, which is peculiarly the domain of the craftsman. His task it is to see that the equipment is properly installed, to operate it, and to maintain and service it.

Together our two groups, as previously stated, cover the entire life of a given piece of equipment. I can conceive of no good reason for either group endeavoring to exert undue influence within the domain of the other. The responsibility in either instance must not be divided by any hazy line but must be clear-cut and decisive, for only in this way shall we ever realize maximum efficiency by either group. Such a situation naturally bespeaks a wholesome and highly beneficial respect by each group for the ability and the true function of the other. Such mutual respect must of itself induce responsibility in the long run.

All of which leads naturally to the extremely important question of competency. The Alliance recognizes the need for continuous insistence upon competency as a vital element in its present welfare and future progress. I know that you engineers will welcome the news that educational activities by units of the Alliance, although necessitating a not inconsiderable personal expense and attendance at classes after a regular day's work, are now at their peak within the period of my association with the organization.

Equally welcome, I am sure, will be the statement that I as President of the Alliance will encourage the continuance and spread of these activities by our members.

The organized craftsmen of this industry deeply appreciate the many contributions made to the art by the Society of Motion Picture Engineers and regard its firm stand for that which is best in

George E. Browne

equipment and operating technique as a definite aid to the present and future progress of the Alliance.

I want to assure the Society of the desire of the Alliance as a whole to render every possible support to the program of the Society for the advancement of the art, and I know that the Alliance membership will applaud the offer I now make as their President to use every influence and facility of my office to further a better understanding and a deeper appreciation of the mutual interests and problems of both our organizations.

New DeVry 35 mm. Reel A Splendid Product

A new 2000-foot reel for 35 mm. theatre projection work that has just been introduced by H. A. DeVry, Inc., of Chicago, promises to solve most of those vexing reel problems that have beset the craft for years.

Exhaustive tests under actual operating conditions in a New York theatre showed that a reel is everything that its manufacturers claim it to be—and more. Perhaps the outstanding feature of this lightweight reel is its indestructibility, a result of the special imported clock spring steel used in its construction, plus careful design. Even the hardest kind of treatment (including repeated jumping on it by a weighty person—which no reel will be subjected to), failed to disturb its perfect alignment.

Large Savings Possible

The importance of this true alignment at all times is hard to compute in terms of film saving in a year through vastly decreased mutilation, but it is no exaggeration to say that the total sum would run to hundreds of thousands of dollars. There is no apparent reason, even after such severe tests, why the real should not last for many years, which fact more than justifies its slightly higher cost.

This new DeVry reel actually can be threaded in the dark, so cleverly arranged is the slot, over which the film need only be drawn in order to catch tightly. Another feature is the complete absence of any rough edges in any part of the reel to tear or scratch film. The reel is so contrived that each section is replaceable, although the need for this money-saving feature is hard to understand in view of the almost complete indestructibility of the unit.

As one who has seen numerous types of reels over a considerable number of years, this writer is glad to endorse this new DeVry reel as a splendid aid to better projection. J. J. F.

AEROVOX WINS PATENT SUIT

Aerovox Corp. announces that the U. S. Circuit Court of Appeals has just rendered a decision in its favor in the Mallory suit against Aerovox for alleged infringement of Ruben patent No. 1,891,-207. The Court held invalid this patent relating to the use of Ethylene Glycol in the making of electrolytic condensers.

The 'Point System' of Estimating Projectionist Wages

ORIGINALLY prepared by the NRA as the basis for an open hearing to have been held in Washington, D. C., on June 4, the appended data relating to proposed wages for N. Y. City projectionists would seem to possess no significance in view of the voiding of the NRA act by decision of the U. S. Supreme Court.

Far from being a matter of purely academic interest is this wage plan, however, because it represents the first application of the so-called "Point System" to a problem involving projectionist pay in the motion picture industry. The system has been used in other industries, however.

The Point System involves consideration of run of picture, type of theatre, seating capacity, and admission price, with special provision being made for picture theatres which also offer some form of stage entertainment. It is desired to emphasize the fact that the following table relates to *total projection room cost*, without relation to the number of men employed on a given shift or throughout a given week. Two, one man or six men, the scale remains fixed, with manpower to be worked out between Union and exhibitor.

INTERNATIONAL PROJECTIONIST will consider this wage-fixing plan editorially in an early issue—probably the next—but for the present it will ask only that the craft give the appended summary its closest attention and thought.

Employees performing the duties of motion picture machine operators in any theatre in Greater New York, which exhibits motion pictures first-run, second-run, third-run or fourth-run, shall be paid in the aggregate not less than $.12 per point per hour for each point shown on the following schedule for a theatre in the seating capacity and admission price classification shown thereon.

Employees performing the duties of motion picture machine operators in any theatre in Greater New York which exhibits motion pictures fifth-run, sixth-run or subsequent-run, shall be paid in the aggregate, not less than $.10 per point per hour for each point shown on the following schedule for a theatre in the seating capacity and admission price classification shown thereon.

Seating Capacity of Theatre	Admission Price to Theatre							
	$.15 or Less	.20	.25	.30	.35	.40	.45	.50 or More
	POINTS							
Less than 600	10	12	14	16	18	20	22	24
600 to 800	14	16	18	20	22	24	26	28
801 to 1000	16	18	20	22	24	26	28	30
1000 to 1200	18	20	22	24	26	28	30	32
1201 to 1400	20	22	24	26	28	30	32	34
1401 to 1600	22	24	26	28	30	32	34	36
1601 to 1800	24	26	28	30	32	34	36	38
1801 to 2000	26	28	30	32	34	36	38	40
2001 to 2200	28	30	32	34	36	38	40	42
2201 to 2400	30	32	34	36	38	40	42	44
2401 to 2600	32	34	36	38	40	42	44	46
2601 to 2800	34	36	38	40	42	44	46	48
2801 to 3000	36	38	40	42	44	46	48	50
3001 to 3200	38	40	42	44	46	48	50	52
3201 to 3400	40	42	44	46	48	50	52	54
3401 to 3600	42	44	46	48	50	52	54	56
3601 to 3800	44	46	48	50	52	54	56	58
3801 or over	46	48	50	52	54	56	58	60

Any theatre in Greater New York shall be deemed to be in the classification of those exhibiting pictures first-run, second-run, third-run or fourth-run, if the majority of the pictures exhibited by such theatre, are pictures exhibited first-run, second-run third-run or fourth-run.

Any theatre in Greater New York shall be deemed to be in the classification of those exhibiting pictures fifth-run, sixth-run or subsequent-run if the majority of the pictures exhibited by such theatre are pictures exhibited fifth-run, sixth-run or subsequent-run.

For the purpose of determining the classification in which any theatre in Greater New York shall be placed as to admission prices, the highest admission price regularly charged for admission to the orchestra section of the theatre, shall be deemed to be the admission prices to which the schedule refers.

Provided, however, that if any theatre in Greater New York presents a stage show, in addition to exhibiting motion pictures, seven additional points shall be added to the number of points shown on the above schedule for such theatre and the total number of points thus arrived at shall be the basis for determining the aggregate minimum compensation for the motion picture machine operators in such theatre.

No employee performing the duties of a motion picture machine operator in any theatre in Greater New York shall be permitted to work more than 30 hours per week.

The figures shown are based upon the data regarding run, admission prices, seating capacity and hours of operation which were furnished that committee. *Any changes in these factors would cause a corresponding change in the totals shown in this list.*

The admission price factor refers to the highest price regularly charged for admission to the orchestra.

The scales arrived at by application of Schedule "A" are minima and wages in excess of the minimum are adjustable only through collective bargaining.

In case of dispute regarding the application of the schedule to any theatre, the case shall be resolved as provided for in Article IV., Division C, Part 1, Section 6.

The following example illustrates the manner in which an exhibitor operating an hypothetical theatre in Greater New York arrives at the minimum rate which the above schedule requires shall be paid to the motion picture machine operators in that theatre.

A motion picture theatre having a seating capacity of 2,281 and showing pictures third-run at regular top orchestra admission price of 30 cents would have a rating, as shown on the schedule, of 36 points. Since this theatre shows pictures third-run it would fall in Class A and as shown in Schedule "A" each point for Class A has a value of $.12 and such theatre would be required to pay not less than at the rate of 36 times $.12 or $4.32 per hour for each hour the theatre is in operation.

EVEN the most ardent pro-Labor citizen was forced by NRA dilatory tactics to despair of any real social progress for years to come, and long before the Supreme Court blasted the NRA codes right out of the picture. A book published by the Brookings Institution, economic research organization of Washington, D. C., minimizes NRA benefits to the country, including Labor.

Discussing collective bargaining under the codes, the report states:

To encourage vigorous enforcement of Section 7a . . .would have precipitated an industrial battle to the finish between trade unions and anti-union employers. These consequences the administration was not ready to face, partly because of the possible effects on re-employment and recovery, partly because of the long range implications of collective bargaining on the economic structure.

Plainly stated, the foregoing excerpt means that the administration had no definite policy with respect to Labor and was reluctant to face the issue of the part to be played by trade unions in America.

The passive attitude of the administration in the face of the severe drubbing administered to NRA by various courts finds the average worker convinced that New Deal social legislation is a sham.

G. T. E. Reorganization

General Theatres Equipment, Inc. (parent body of National Theatre Supply and various manufacturers) will receive from Chase National Bank 170,000 shares of Fox Film Corp. common stock, under the terms of a reorganization plan. G. T. E. will also have two years in which to acquire an additional 320,000 shares of Fox at $15 the first year and $17 the second year. G. T. E. will also receive back from Chase 19,770 shares of National Theatre preferred and 24,640 International Projector Corp. stock.

The plan provides that bondholders of G. T. E. will receive 10 shares of stock for each $1000 bond and that the bank creditors will participate on the same basis. Also, bondholders and the bank creditors have been granted options to acquire 6 shares of additional common at between $10 and $12 a share.

Joe Cifre Leaves N. T. S.

Offers New Service

Joe Cifre, for many years one of America's leading theatre supply dealers and a member of Boston Local 182, has resigned as manager of the Boston branch of National Theatre Supply Co., effective May 31. His successor has not been announced.

Cifre will immediately launch a new enterprise under the firm name of Joseph S. Cifre, Inc., which will serve as technical consultant and purchasing counselors for every type of theatre equipment. Theatres desiring the service will pay a small annual fee. Cifre expresses confidence that his service will save the theatre the cost of the annual fee many times over. More than 20 theatres have already subscribed, according to Cifre.

Cifre's connection with show business extends back for many years. His father opened the first 5-cent picture show in Boston in 1904. Joe himself has been a projectionist since 1906.

★ NEWS NOTES ★

The following directors of National Theatre Supply were re-elected at the recent annual stockholders' meeting: W. E. Green, M. V. Carroll, D. O. Hastings (U. S. Senator from Delaware and receiver for G. T. E.); E. G. Hines and Wm. Sheperdson. Officers re-elected are: W. E. Green, president; M. V. Carroll, secretary and treasurer, and R. B. LaRue, asst. secretary.

Vocafilm vs. Erpi

Vocafilm having sued Erpi for $65,000,000 in an anti-trust action, Erpi entered a defense that Vocafilm had no right to sue because its patents infringed on those of A. T. & T. and its subsidiaries. Vocafilm's contention is that these patents are invalid.

Upon being informed that Vocafilm had no funds with which to test the validity of the patents, Federal Judge Knox in U. S. District Court in New York, ordered that Erpi, having adopted this line of defense, would have to supply $10,000 to prove their validity.

Another Chicago Killing

Clyde Osterberg, organizer for an independent projectionist union in Chicago, died as a result of four bullet wounds inflicted upon him by unknown gunmen. Osterberg lingered for ten days before succumbing and, although admitting he knew his assailants and their reason for shooting him, refused to give any information.

Erpi Agents Busy

Erpi representatives are explaining to exhibitor gatherings the new Erpi servicing plan, involving allegedly vastly lower costs. The argument advanced embraces: no selling of other than Erpi equipment; vastly lower costs; a schedule of 12 visits annually for theatres operating less than a full week, 17 visits for the "average" theatre, and 52 visits for the "de-luxe" theatre; optional contracts.

The wide variance between "necessary" service calls of 17 annually for the "average" theatre as compared with 52 for the "de-luxe" theatre is not explained.

T. C. Barrows on Tour

Thad C. Barrows, president of Boston Local 182, attended the S. M. P. E. Convention in Hollywood and then continued on to Honolulu. He will be gone six weeks. Local 182 tendered a farewell party to Barrows on May 12 at the Cocoanut Grove, Boston, which attracted a turn-away crowd of civic, trade and Labor leaders.

Barrows, a member of several S. M. P. E. committees, is president of the Projection Advisory Council.

Chase Big Fox Holder

Chase National Bank holds 1,549,507 shares of 72.3 per cent of the Class A common stock of Fox Film, according to data filed with the N. Y. Stock Exchange. The J. E. McAuley Mfg. Co., of Chicago, makers of Peerless projection lamps, is listed as holder of record only of 8,333 shares.

Rosenblatt to Quit

Sol A. Rosenblatt, division administrator and national compliance director of NRA has announced that he will quit NRA and resume private law practice on June 15. Reports that Rosenblatt had been engaged as counsel to the I. A. T. S. E. were denied by President George E. Browne.

Independent Dealers Meet

The following companies have already arranged for exhibits at the forthcoming convention of the Independent Theatre Supply Dealers Assoc., in Chicago, June 15-19:

H. A. DeVry, Carbon Products, Baldor Electric, Wenzel Co., Platter Sound, Brenkert Projection Co., Da-Lite Screen, Neumade Products, General Electric, National Carbon, Forest Mfg. Co., and Continental Electric.

A Special Test Film For Craft From S. O. S.

A specal test film prepared especially for use by projectionists has been developed by S. O. S. Corp. to meet the steadily increasing demand by the craft for such a servicing aid. The test film contains three sound tracks, two of which are practically the reduced image of the rungs of a ladder, having an 1100-cycle, or high, note on one side, and a 300-cycle, or low, note on the other. The film also has a 9000-cycle note for checking the optical system.

This test film is used to check the correct alignment of the sound track on the sound head aperture with relation to the light, or scanning, beam.

Reflecting widespread demand by the craft, this test film is available, together with special detailed instructions for its correct use, through S. O. S. at 1600 Broadway, N. Y. City Film is endorsed by I. P. as a valuable servicing aid.

The New RCA Sound Track

By JAMES FRANK JR.

THE process of recording sound-on-film is a very simple one and in general is quite similar to that of reproducing sound from film. In order to photograph sound it is necessary, of course, to in some way transform the sound waves—which vary both as to frequency and amplitude—into directly proportional light waves, which may be directed at the negative film. It has been found most practical to accomplish this by first transforming the sound waves into electrical waves which can be easily amplified to a useful intensity and then transform the electrical waves into light waves.

There are in general use two distinct methods of recording sound-on-film. One employs a galvanometer for transforming the electrical waves to light waves and produces a *variable area* sound track. In this case there is a single contrast of black and white with varying portions of the sound track being exposed.

In the other method a light valve is employed, producing a *variable density* sound track. In this case the entire width of the sound track is always exposed, but with a varying density ranging from black through gray to white.

Variable Area Advantage

RCA High Fidelity sound-on-film recording employs the variable area method. There are several distinct advantages to this method of recording over the variable density method consisting essentially of the following:

1. In the use of variable area, variations in film processing and difficulties encountered in the care of the film will not affect the quality of reproduced sound to the same degree as it will in the case of variable density recording.
2. Variable area recording permits greater output level.
3. The apparatus required for recording sound-on-film by the variable area method is considerably simpler and easier to control.

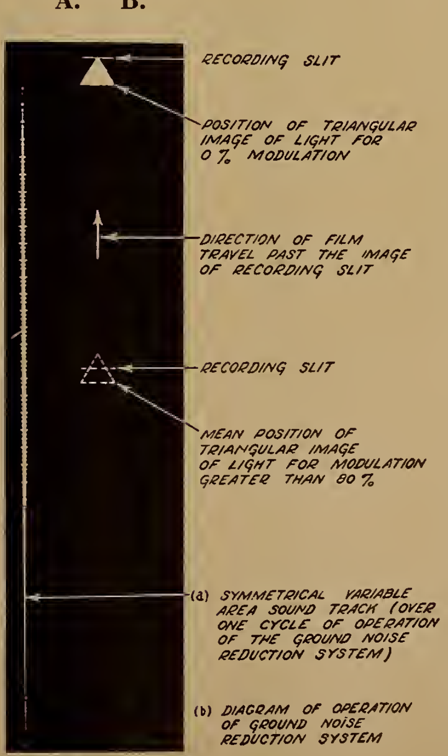
The RCA High Fidelity method of recording sound-on-film will be described in some detail herewith.

Probably the most important piece of apparatus employed is the recorder device. The recorder consists of a machine designed for moving 35 mm. film past the light beam at an absolutely constant speed of ninety (90) feet per minute. RCA recording devices employ a novel device consisting of a magnetic drive for accomplishing this necessary constant motion of the film.

The Optical System

The optical system, which includes the galvanometer, consists of a constant source of light focussed through an equilateral triangular mask on the mirror of the galvanometer. The galvanometer consists of a rod with a coil wound around it mounted with its axis perpendicular to the surface of the film in a magnetic field with a very small mirror about one-eighth of an inch square mounted at its end nearest the film. The image of the light is reflected from the mirror through a slit 70 mils wide and ¼ mil thick onto the portion of the negative film reserved for the sound track.

When no current is passing through the coil on the rod of the galvanometer, the mirror is adjusted so that the reflected image exposes the center half, or 35 mils of the sound track. When the varying electrical waves from the microphone, having been amplified, pass through the coil of the galvanometer, a motor action occurs causing the rod to move in a vertical plane.



The RCA Sound Track

Since the current is an alternating one, the rod really swings with a pendulum motion upwards and downwards in direct proportion to the intensity of the electrical waves. The result is that the mirror, of course, moves up and down too, and the reflected light image exposes more or less of the slit in direct proportion to the electrical waves. Maximum motion in one direction exposes 70 mils, and in the other none at all. The result is that the sound track portion of the negative film is exposed by a line of light ¼ mil thick and varying from 0 to 70 mils in length.

Since the film is moving at a speed of 90 feet per minute during the process, the resultant negative sound track appears to be an exposed portion in the middle of the sound track, both edges of which consist of symmetrical peaks and valleys. The shape of these peaks and valleys depend upon the frequency and amplitude of the recorded sound. When the negative is printed the sound track on the positive film is just the reverse: that is, the *center portion* of the sound track is transparent and the *outside portions* of the track are opaque with symmetrical peaks and valleys upon the inner edge.

Ground Noise Reduction

In order that the exposed portion of the film be reduced to an absolute minimum, resulting in a minimum amount of transparent sound track on the positive film which would permit stray light to pass through it, or on which dirt might collect, affecting the light passing through it and thereby causing extraneous noise in the reproduced sound, a method known as "ground noise reduction" is employed.

This is accomplished by taking a small portion of the electrical signal, amplifying and rectifying it to a direct current, and passing it through a second coil wound on the rod of the galvanometer. This system is adjusted so that when no signal is passing through the galvanometer, the mirror has been pulled down in a position where somewhat less than one-half, or 35 mils, of the track is exposed. Its effect, however, is varied in such a way that it decreases as the amount of signal or modulation increases. In other words, at 0% modulation its effect is greatest, but at 80% modulation its effect is eliminated. By so doing, the amount of track exposed is kept at a minimum.

• Letters to the Editor •

A Lumiere Booster

I read with great interest the story, "Three Dimensional Movies Re-Invented by Lumiere," in your April issue, *after* reading the newspaper article which evidently formed the basis for your story. Having been privileged to read the original text matter by Lumiere on the subject, I think that I. P.'s article contained some uncalled for statements.

Possible the effort of the *N. Y. Times* technical editor to put the Lumiere story in simple language resulted unfortunately, judged from a strictly technical viewpoint. In the same position as he, you probably would adopt a similar course with, say, an article describing a substitute for the intermittent movement.

Your readers may gain the impression that Lumiere is a technical "slouch." He isn't; and his technical achievements to date are of paramount importance, particularly in the field of motion pictures. Lumiere's contribution may be very important to the art of three-dimensional motion pictures. Consider, for example, the three separate and distinct contributions of Fleming, Edison and, finally, De Forest to the making of what is today the simple three-element vacuum tube.

Samuel Wein
Bronx, New York City

No attempt to minimize the contributions of Lumiere was made. Still, as "Selenium Cell Sam" well knows, analyzers as a means for realizing three-dimensional movies have whiskers in the year 1935. The realities of the art, even without third-dimension and extensive use of color, are amazing enough in themselves, if only technical editors for the popular press weren't too busy conjuring up "inventions" to see it.—*Ed.*

Why Not Independent Sound Equipment?

I congratulate you on your stand regarding the projected Erpi servicing grab . . . In fact, I have heard several producing officials remark upon your "invigorating independence." You undoubtedly will lose some advertising revenue as a result of this campaign, but with other manufacturers flocking to your advertising pages I am sure that your net gain will be considerable.

May I suggest that in your articles and editorials you mention not only RCA as an alternative source of supply but also S. O. S., which we feel is a real quality equipment, easy to service and handle. True, RCA has simplified its apparatus to a great extent, but it still is a highly complicated equipment and one which few projectionists can care for themselves.

S. O. S. Cinemaphone equipment is designed with the utmost simplicity and has been made with the small-town situation in mind, where projectionists may be a considerable distance from the nearest large city. Further, we supply a full schematic diagram of all sound equipment together with a chart listing every possible trouble and hints for its remedy. This puts the projectionist strictly on his own and enables him to cope with any emergency, without the electrics' servicing man.

While we ask as a client of yours that our name be included in any equipment recommendations you make, we are not selfish about the matter, because there are at least fifteen other good, strong independent manufacturers whose products today are just as good as anything either Western Electric or RCA ever made. In justice to all, please do not give RCA all the "breaks."

Apart from this, we are with you in your fight for a square deal for this field, and we know that other manufacturers feel similarly.

J. A. Tanney
President, S. O. S. Corp.

Perfectly justified in this respect, although the editorial in question did recommend "RCA or any other equipment . . ." I. P. gladly states that its "break" was not intended to be confined to RCA but includes other sound equipment manufacturers as well. Particularly welcome is statement that S. O. S., in sharp contrast with some other manufacturers, supplies complete schematics and a trouble chart with all sound equipment. Of this more on the editorial page.—*Ed.*

Rectifier Prices

On pages 18 and 23 of your April issue appear the following statements:

"Mr. Hoffman's original minimum rectifier figure of $160 is too low; while his bulb figure of $15 is too high."

"No projection rectifier has a list of $160, and nobody that we know of pays $15 each for bulbs."

In a recent advertisement of the Baldor Electric Co. in your own columns the Rect-o-Lite was listed at $160. All of the independent theatre supply dealers have our literature listing a quality rectifier for $160, as per copy attached. Also, the *list price* for 15-ampere bulbs *is* $15, as Mr. Hoffman stated.

I know you will welcome an oppor-

MAX RUBEN

THE death of Max Ruben on May 1 robbed the craft of one of its finest personalities. Business representative of Local 199 of Detroit for many years, as well as one of the foremost theatrical supply dealers in America, he left behind him a host of genuinely sorrowing friends.

Max commanded the friendship of all with whom he came in contact, whether individuals or groups. To be associated with him as his friend for even a brief time was a privilege that those so favored will never forget. His honesty and deep sincerity, his positive passion for truth and justice saturated his every fibre, his entire being.

But it was as a humanist that Max endeared himself to this writer and countless other friends. Upon those who knew him intimately he left an indelible imprint for that which was good and right and just.

His record as business representative of Local 199 is a saga of the Labor movement. The standardized hero-type of fiction never exceeded—nay, equalled—the record of self-sacrifice and incredible endeavor which Max Ruben compiled in the interests of Labor. This writer, for one, will never forget the story of that steaming hot August night a few years ago when Max unflinchingly faced death rather than betray his word and the faith of those whom he served.

It is not known to how many people Max Ruben was indebted for favors in this world, but whatever their number, it is certain that it is puny by comparison with the number of those who were helped over life's uncertain course by him.

The most compelling item in the long list of virtues possessed by Max Ruben—or, rather, which possessed him—was his really beautiful conception of and unvarying adherence to the humanities. People were always flesh and blood to him, and their trials, sorrows and hurts dug so deeply into his own pain-wracked body that he couldn't rest until he had extended aid or comfort. And if one were his friend . . . well, the heavens opened and showered down upon one every aid that one human could muster.

Feeble words these, and yet it must be recorded that Max Ruben's word was his bond. Indeed, his finest tributes came from his competitors whom he outwitted in business by reason of his astonishingly fertile mind and vast store of energy. Still, with all his success in business and accomplishments in his chosen field of endeavor fresh in mind, the most vivid impression of Max Ruben and the one that blots out all others is that of him as a humanist.

On the letterhead of the Amusement Supply Co. of Detroit, which he conducted for the past several years, there appears a line which renders futile and inexpressive all these words and which will serve as the valedictory of Max Ruben. It read: "He profits most who serves best."

God rest your noble soul, Maxie, that line was written just for you.

J. J. F.

tunity to publish this correction, in fairness to our rectifier.

MAX L. ROBINSON
Baldor Electric Co.
St. Louis, Mo.

I. P. apoligizes to Baldor. The Rect-o-Lite, has a list of $160, as advertised in these columns and elsewhere. While it is true that the figures in Mr. Hoffman's articles were all based on list prices, the fluctuating discounts allowed on tungar bulbs, ranging from 15% to 50% and more, merited the citation of $15 as an exorbitant price.—*Ed.*

Patent Abuses Cited By Reform Group

Consumers and industry alike are the victims of abuses of patent pool monopolies which must be eliminated in the public interest, is the verdict of public opinion as set forth in a booklet released by the American Economic Foundation of 20 Exchange Place, New York City.

These findings are the result of a national survey conducted by the Foundation, which was organized to secure for the American people the economic benefits of science and invention in industry by opposing the abuses of patent monopolies, patent pools and royalty dictatorships in restraint of trade.

According to the opinions of business men, scientists and others, as set forth in the booklet, the principal abuses of the patent pool monopolies are:

Costly litigation, carried over long periods of time, an expense passed on to the consumer.

Suppression of inventions, depriving consumers of new conveniences, and industry of new sources of business.

Unfair competition in restraint of trade, including price fixing agreements, officially or unofficially arrived at.

Discouragement of small inventors, by monopolizing their market and offering little or no reward for their their work.

Citing these and numerous other abuses of patent pool monopolies, contributors to the booklet urge reform in the patent system, stating that not until the evils disclosed are abolished will the American public recover the benefits of scientific invention.

According to the Foundation, consumers today are the victims of the abuses of patent pool monopolies. It recommends that consumers oppose the abuses of our patent system, protest higher prices resulting from patent pool monopolies, and encourage progress by recovering for the American people the benefits of inventive genius by opposing the evils now existing in the system.

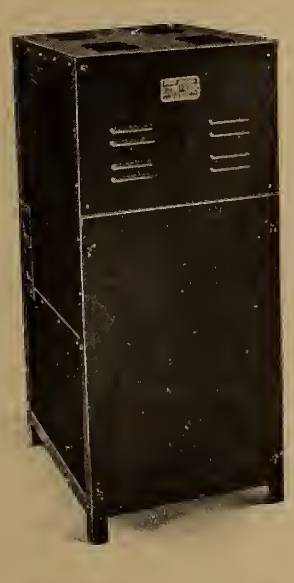
A. T. & T. EARNS 30 MILLIONS

A net income of $30,097,288 for the first quarter of 1935 is reported by the American Telephone & Telegraph Co.

Have **YOU** *Seen It?*

THE FOREST TWIN 50

COPPER OXIDE RECTIFIER



FOREST TYPE TWIN 50
C-O RECTIFIER

—employs the copper oxide units, insuring long life and quiet, trouble-free and efficient operation—all with a maintenance cost that is nil.

For 2 Projection Arcs - -

AND A SPOT!

LIST PRICE: $500

• FOREST Twin 50 is the ideal power supply for TWO Suprex arcs, of 30 to 50 amperes each. It will also supply a 30 to 60 ampere regular carbon arc Spot Lamp, 50 to 55 volts.

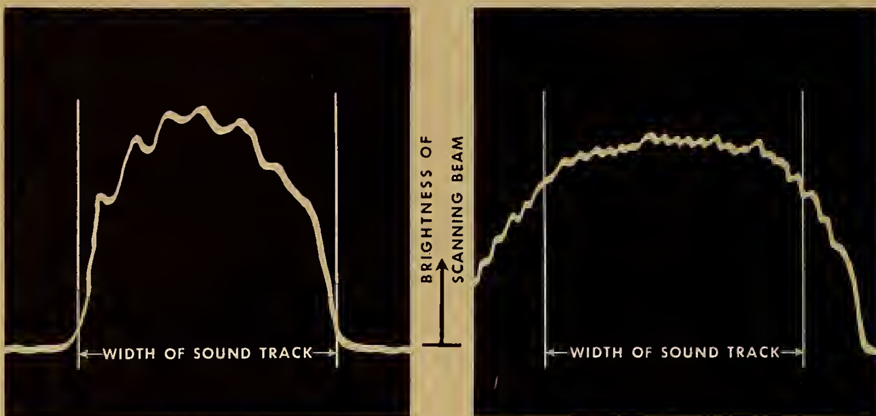
• SEE your dealer today, or write to us for detailed information about this up-to-the-minute rectifier development for modern projection arcs.

FOREST MFG. CORP.

Rectifier Specialists

Belleville **New Jersey**
U. S. A.

MICRO-RECORDS
of the SCANNING BEAM
help to attain better sound



Here is the story of two exciter lamps and one lens system. The wrong combination of lamp and optical system, at the left, fails to reproduce the sound as recorded on the film. The beam is uneven in brightness and fades off before it reaches the edges of the sound track. The correct combination, at the right, covers the full width with more uniform brightness and radically improves the reproduction.

SUCH records taken with the micro-photometer of the Nela Park Engineering Department make it easy to determine the brightness *in each one-thousandth of an inch* along the tiny scanning beam for any lamp and optical system. This helps us to determine the type of filament which is best adapted to any one lens system; and to work with optical designers in developing better combinations of lamps and lens systems for accurate sound reproduction.

The importance of this work to the projectionist and exhibitor is two-fold: when the brightness of the scanning beam is uneven, you can not secure true reproduction of the recorded sound; and when the light is too low in brightness, the cost of reproduction is increased.

General Electric scientists and engineers are constantly making studies such as these to insure that Edison MAZDA photo-cell exciter lamps will give you faithful reproduction of sound . . . at low cost. General Electric Company, Nela Park, Cleveland, Ohio.

EDISON MAZDA LAMPS
GENERAL ELECTRIC

Clayton Quality Products

- Clayton even tension take-ups are made for all projectors and sound equipments.
- Also the maker of the Clayton combination even tension winder and brake.

CLAYTON PRODUCTS CO.
31-45 Tibbett Avenue New York, N. Y.

New Metal Tubes Induce Stiff Trade Fight

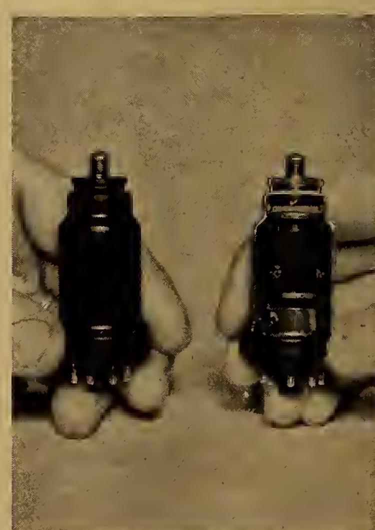
NEW metal radio tubes, which tests indicate to be of greater continued efficiency of operation than the glass type now in use, have been announced by General Electric. These new metal tubes are not only much smaller and more sturdy, but offer many improved electrical characteristics over the conventional tubes of today.

They provide their own shielding and the metal shell is a better heat conductor and radiator than glass. The short leads of the tubes permit greater amplification at the higher frequencies and the more effective shielding insures greater stability. These tubes are not interchangeable with glass tubes.

The metal tubes are cylindrical in form, some in reduced diameter at the top. Others, such as a r. f. amplifier, have a terminal at the top extremity. Each lead-in wire passes through a tiny bead of special glass that is fused securely within an alloy eyelet, which in turn is welded to the metal container, thus assuring a long life vacuum. This alloy, having substantially the same coefficient of expansion as glass, is known as Fernico and is a combination of iron, nickel and cobalt. It was developed expressly for the purpose of a perfect seal on the new tubes.

Smaller, Stronger, Better Shielded

In the main, the new tubes are less than half the size of the familiar glass tubes of corresponding rating. The metal shells are, of course, much stronger than glass bulbs, and not subject to breakage, while the use of short,



New metal tubes (actual size)

stiff supports in the new tubes results in less mechanical vibration of the internal elements.

Elimination of the glass "pinch seal," in which all leads and supports are concentrated in the glass tubes, allows the leads to enter the header of the new tube at the proper points for short, direct paths. Also, the new design permits a logical arrangement of connec-

tions and supports between base pins and electrode structure.

The familiar metal shield which is necessary with the glass tube in r. f. portions of a circuit is not required with the new tube. The metal envelope itself serves as a shield. And, since closer proximity of shield to elements can be realized, the shielding is more effective. Whereas, in certain types of glass enclosed screen-grid tubes the anode is shielded first by an internal structure, next by a coating on the inside of the glass bulb, and finally, when in use, by an external "can," in the new metal tube all these functions are performed by the shell.

A further favorable feature of the metal shell, G. E. believes, is that it contributes to residual gas cleanup, thus promoting continued efficient operation.

New Pin Arrangement

The new tubes have one more base pin than comparable glass tubes, since the metal envelope has become the shield, and provision must therefore be made to ground this envelope. Designers have even taken into consideration greater ease of inserting it in the socket. In the present conventional glass tube, two of the base pins are of larger diameter than the others, necessitating alignment of these larger pins with corresponding socket holes.

In the base of the new tube, all the pins are of the same diameter, and in the center is a longer insulated keyed pin. By placing this insulated pin in a hole centrally located in the socket, and rotating the tube until the key slips into its groove, the tube is quickly and easily inserted.

The metal construction has been applied both to existing types of glass tubes having indirectly heated cathodes, and to other newly-developed tubes. Included in these is a duo-diode, which is only about five-eighths of an inch high above the base, and a hexode, which is an improved pentagrid converter.

The engineering contributions cited by G. E. as having helped make the metal tubes possible, are:

A new, sturdy seal to replace the troublesome and expensive feather-edge type of glass-to-metal seal.

Accurately controlled seam, spot and projection welding for the fabrication of the envelope or shell.

A vacuum-tight means of sealing off a metal exhaust tabulation.

INCREASE YOUR WINNINGS

WITH THE

RCA VICTOR PHOTOPHONE

GIVES GREATEST SOUND SATISFACTION AND OFFERS YOU:

• A Sound Box-Office Attraction • Complete Ownership • A Self-Liquidating Investment • RCA Super-Service

PHOTOPHONE DIVISION

RCA MANUFACTURING CO., INC.

Camden, New Jersey

A Radio Corporation of America Subsidiary

HIGH FIDELITY

Philco Opposes New Tubes

Promptly upon announcement by G. E. of the new metal tubes, the Philco Radio & Television Corp. used full-page advertisements in leading newspapers to register its opposition thereto. Excerpts from the Philco blast follow:

Metal radio tubes in England were a dismal failure. They are now defunct. Progress continues on glass tubes; experimentation on metal tubes should be encouraged. Metal may possibly some day take its place alongside glass for radio tubes. In Philco's opinion that day has not arrived as yet.

Here are some disadvantages of metal radio tubes:

1. With the proposed American metal tube construction, bulb size is reduced. With an equal amount of heat to dissipate, the smaller metal tubes must operate at a higher surface temperature than the larger glass tubes.

High temperature is not only detrimental to tube life, but changes the characteristics of nearby coils, resistors, etc., thus impairing the delicate balance of all the component parts, which is absolutely necessary for fine performance. This could be avoided by spacing the coils farther away from the metal tubes, but this requires *more* space, not less.

2. Production difficulties in the proposed metal tubes restrict the manufacturer of certain highly desirable multiple function types which are in general use in glass. The proposed metal tubes are limited to a few types—principally single function types.

3. Thus, to achieve a given performance, more metal tubes than glass tubes are required. This again requires more, not less, space in a radio.

Cites Costs, Other Defects

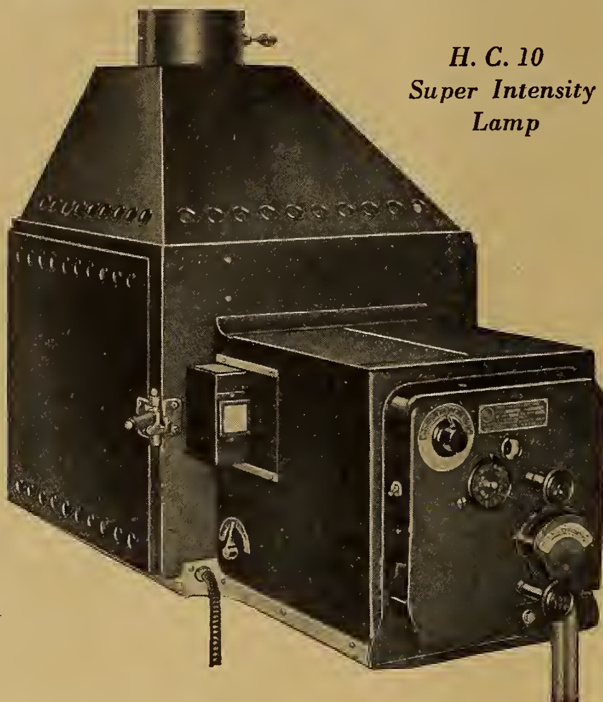
4. Also, the additional metal tubes add to cost and electric current consumption without adding to performance.

5. The transparency of the glass tube often allows the user to determine when

Only High Intensity Arcs Give
HIGH INTENSITY PROJECTION

H&C Inc.

H. C. 10 Super Intensity Lamp



The Lamp With Accurate Arc Regulation

Descriptive booklet on request. Write for it to

HALL & CONNOLLY

24 Vandam St. New York, N. Y.

Your Preference —Please

We solicit your aid, Mr. Reader, to the end that *International Projectionist* may render the maximum service to its readers. You can help to improve this service by stating your preference for editorial matter.

What type of articles, drawings, photographs and features do you prefer? Use the space below to record these preferences. We'll do the rest.

USE THIS FORM

Editor, INTERNATIONAL PROJECTIONIST
Sir: I should like to have published in INTERNATIONAL PROJECTIONIST articles (or drawings) relating to the following subjects:

1. ....
2. ....
3. ....
4. ....

Name ....

Address ....

a tube is not functioning. It is a great help in factory inspection. The inability to see inside a metal tube is a real disadvantage.

6. Loss of vacuum is a serious hazard in the proposed American metal tubes, because, as compared to glass tubes, they require twice as many vacuum seals and each seal is much more intricate. Any air leaks at any one of the sealing points in any metal tube stops the radio from working.

In the wide choice of types of glass tubes, a higher power output of pure tone is available as compared to the proposed metal tubes.

Also, glass tubes are practically foolproof. With all their highly scientific design, breakage in the factory and in service is practically nil. Their ruggedness is attested to by the fact that they are universally shipped installed in their sockets ready for use, and that they withstand transportation by rail, truck, steamship, and loading and unloading, without injury or breakage. Also, millions of radios using glass tubes are in daily use in automobiles and trucks driven over all kinds of roads.

[NOTE: *Proponents of the new metal tubes, replying to Philco, stated that the opposition had its roots in the necessity for redesign of radios and other sound reproducing systems for use of the metal tubes. Metal tubes for theatre sound systems probably will not be developed for at least a year.*—Editor.]

RCA HIGH FIDELITY GAINS

New RCA Victor High Fidelity sound reproducing systems are to be installed in 23 deluxe RKO theatres all over the country, according to word from Edwin C. Hartley, manager of the Photophone department. With these installations completed, the RKO circuit will have been practically 100% equipped with the very latest reproducing equipment.

Tri-State Motion Picture Co., industrial picture organization of Cleveland, Ohio, has completed a license arrangement whereby all recordings will be made by RCA High Fidelity equipment.

In Michigan— it's the

AMUSEMENT SUPPLY CO.

208 W. Montcalm St.
Detroit, Mich.

for the best and most complete stock of theatre equipment—including visual and sound projection supplies—at the leading independent theatre supply house in the Middle West.

TELEVISION AND THE MOTION PICTURE

(Continued from page 16)

ing such figures since there are numerous other economic factors involved in a valid comparison.

WHILE it is not feasible within the limits of this presentation to give even an outline of the various methods employed in modern television, some numerical data concerned with picture detail may be included as of present interest.

These consist first of a personal opinion, in terms of motion picture terminology, of the value and characteristics of television pictures having various numbers of dot-elements composing them. The figures are understood to be merely generally descriptive, but it is believed they are instructive in judging the "motion-picture value" of various television systems:

10,000-element pictures—these give a fair close-up of a single person (head and shoulders)

20,000-element pictures—these can show two persons in a close-up moderately well (though without fine detail)

40,000-element pictures—fair medium shots become possible

80,000-element pictures—good medium shots, and fair long shots can be shown

160,000-element pictures—excellent close-ups of several persons, good medium shots, and acceptable long shots (except for unusual "pageant" subjects and the like).

'Sideband' Requirements

Taking the last-mentioned type of television picture, and assuming a flickerless transmission, it is found that the required "sidebands" produced by the picture modulation of the ultra-short-wave carrier have a width of the order of 1.5 megacycles (or about 150 times the frequency band required for high-fidelity 10,000-cycle sound reproduction)!

Passing to the subject of topic (*c*) above, namely the contacts and cooperative possibilities between motion pictures and television, it is clear from the beginning that there can be a close connection, if such is desired.

A person viewing a small picture in motion with synchronized sound might find some difficulty in knowing whether he was viewing a sound motion picture projected from film or a television-telephone broadcasting reception. He might be even more puzzled if the subject matter were, say, a newsreel used to control the television-telephone transmitter, an entirely feasible procedure.

Obviously the technique of producing a television-telephone broadcast program will closely resemble that of producing a sound motion picture. Methods of costuming, make-up, script construction, "camera" technique, sound pick-up, set construction and illumination, and the like may well be similar in the two fields though probably not with the same degree of elaborateness in the case of television.

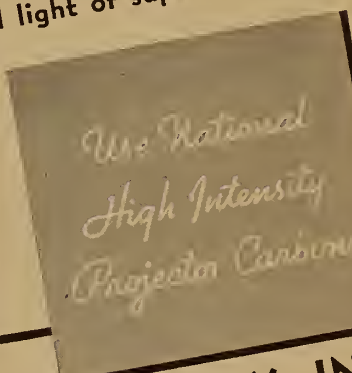
One Sharp Distinction

There is one respect in which they will necessarily differ if an original performance (rather than a film record) is broadcast. This is a limitation of television-telephone broadcastings, namely, the possibility of only one "take," to wit, that one which is broadcast. In motion picture production, any reasonable number of takes may be made; not so in broadcasting where the radio wave irrevocably carries the selected performance to all homes.

As has been mentioned, sound motion picture films may be excellent subject matter for programs from some stations, and may even afford one means of syndicating programs in somewhat the same way electrical transcription (phonograph disc records of programs) are now used.

It is not believed, however, that television-telephone syndication operation will be fully satisfactory unless there are also actual interconnecting wires or radio networks between the outlet stations, since there will be many occasions—for example, a speech by the President, a political Convention, an evening prize fight, and the like—where the public can hardly be completely satisfied by any radio performance which does not take place at the same time as the

The popular, new colored films are photographed in the snow-white light from National Motion Picture Studio Carbons. Perfect reproduction requires projection light of the same quality. Powerful light of superior quality and intensity for color and for improved black and white projection is now available for theatres of every size.



NRA CODE

NATIONAL CARBON COMPANY, INC.
CARBON SALES DIVISION, CLEVELAND, OHIO
Unit of Union Carbide and Carbon Corporation
Branch Sales Offices: New York, Pittsburgh, Chicago, San Francisco

actual event. Indeed it must be admitted that this is one of the outstanding capabilities of radio broadcasting which it would be unwise to discard.

Many persons are convinced that television broadcasting will whet the appetite of the "lookers," and, so far from diminishing the theatre audience, will build it up by arousing interest among children and adults alike in the probably more elaborate and highly developed offerings of the theatre. It is also clear that the theatre can, to a considerable extent, utilize radio advertising by television-telephony—for example, by the sponsored transmission of trailers of one sort of another. Radio will then offer the theatre a remarkably effective method of submitting its "sample line" to the public.

This brings us to topic (*d*), namely, the possible effect on the theatre of the widespread acceptance of television-telephone broadcasting. We are inclined to be definitely optimistic as to this. The argument that television broadcasting may keep people out of the theatre does not appear to have much weight. Consider, for example, the following controlling principles:—

Effect Upon Existing Theatre

(*a*) Intrinsically the home is certainly not so good a showplace as the theatre. It is more difficult to suppress natural and man-made noise in the home; home manners tend to be more "free and easy" than is desirable for showmanlike presentations; the problem of setting up the theatre in the home is far from simple when furniture must be moved to get a good view of the screen and the home folks and guests gotten into the corresponding convenient viewing positions; and home lighting is rarely as controllable or suitable for picture presentation as is the case for the theatre.

Indeed, the customary surroundings of the home are not especially favorable for the creation of a world of illusion which has always been the successful function of the theatre. It is not maintained that there will not be value and interest to the home presentation; quite the contrary. It is however stressed that the home has certain disadvantages of long standing for program presentation which cannot be disregarded.

(*b*) Conversely, the theatre has a number of definite and inherent advantages as a showplace. It arouses the interest of the audience by heavy theatre advertising in the press, by the play-up of the "fan magazines," and by other exploitation methods known to skilful managers, thus creating the proper mood of pleasurable anticipation in the prospective audience. The marquee and lobby of the theatre, ablaze with light and motion, and with attractive photographs of selected scenes from the picture displayed within, further attract the audience.

Within the theatre, suave but real discipline is maintained by the ushers—a task calculated to daunt the bravest in the home. Furthermore, the price of admission, exacted at the box office just before entry, is a powerful deterrent to lack of interest on the part of the audience. It takes a poor picture indeed to force the audience to cheat itself by inattention.

The program in the theatre generally is a well-planned arrangement of elements which fit together and which take as long as may reasonably be required to get the desired effect. In broadcasting, because of certain administrational problems, the successive elements of the evening program are coordinated only with the utmost difficulty, if at all, and necessarily run in 15- or 30-minute slices—a not always convenient or artistic time. At the present time, with the occasional obnoxious exception of excessively prolonged or unduly fulsome blurbs relative to approaching attractions, the theatre screen is practically free from advertising; whereas adver-

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National Service never relaxes. It is ready to help you with your renovation, re-equipment and repair problems. Only equipment of KNOWN QUALITY. Carpets, seating, screens, projectors. Send for catalog. National is PREPARED to SERVE your theatre.

NATIONAL THEATRE SUPPLY CO.
92 Gold St. New York, N. Y.
or
Office Nearest You

How Many?

Was this copy dog-eared when it came to you? How many men read it ahead of you?

You would receive a clean, fresh copy *if* you had a personal subscription—and you wouldn't have to wait—you would be first to read it.

Use coupon below.

INTERNATIONAL PROJECTIONIST,
580 Fifth Ave., New York, N. Y.

Enter my subscription for
☐ 1 year—12 issues—$2.00
☐ 2 years—24 issues—$3.00

Name ....

Address ....

City .... *State* ....

HAYFEVER

ASTHMA and SUMMER COLDS are unnecessary. Complete relief only $1.00 Postpaid. Nothing else to buy. Over 40,000 HOLFORD'S WONDER INHALERS sold last year alone. Mail $1.00 today for full season's relief to THE DANDEE CO., 252 HENNEPIN AVENUE, MINNEAPOLIS, MINNESOTA, or write for Free Booklet.

tising and the sponsored program are at present the commercial basis of the maintenance of broadcasting. The elaborate perfection of some feature pictures will be duplicable only rarely within the necessary economic limits of broadcasting.

To the preceding factors may be added the air conditioning of many theatres and the attempts at comfortable theatre seating, lighting, and the like. All in all, theatres may be expected to be attractive places of the public regardless of other entertainment media.

(*c*) If we consider some deep-seated characteristics of human beings, it becomes further evident that the theatre has certain ways of holding its own alongside of a successfully developed television-telephone broadcasting set-up. People are interested in change. If they are in the home a good deal—and most of them are—they naturally will seek some of their entertainment and diversion elsewhere. The remarkable vogue of the automobile in which people wander rather aimlessly from one place to another largely for the sake of motion is a case in point.

Also, people are gregarious and somehow seem to have their emotional responses enhanced by crowd enthusiasm. One can readily observe this at sporting events, political rallies, revivalist meetings, and other occasions where collective enthusiasms or emotional responses are developed. Then, too, people are distinctly conservative in their pleasures and not prone to abandon hastily anything (the theatre) which for a number of centuries has proven a trusty source of entertainment and amusement.

It seems most likely that the theatre and television-telephone broadcasting will each be successful fields in their own domain, and that *the theatre need not be unduly apprehensive over the advent of television.*

Task Confronting the Theatre

Nevertheless, it must in all candor be emphasized that film producers and theatre managers must not be merely content with past achievements. To hold their position of leadership in their own chosen fields, they must steadily improve and frequently experiment. It is necessary that they shall use whatever good ideas or methods may spring from television broadcasting, for example. A merely superior or indifferent attitude toward new arts or toward improvements in their own older art may prove a first-class passport to diminished public acceptance and ultimate oblivion.

Of necessity the motion picture industry must also fully avail itself of all the skilled advice and guidance which it can secure only from the relatively few experts who are acquainted with both the theatre and broadcasting. Few things would be more dangerous to the motion picture industry than dependence on certain of the pathetically absurd mistatements which have been widely circulated by certain of its members.

However, given its natural advantages, a forward-looking attitude, real initiative, and careful planning, there appears to be little doubt that the motion picture theatre can hold an enviable position of public acceptance and resulting prosperity in the future as in the past.

S.O.S.

The World's Largest Independent Manufacturer of Theatre Sound Systems

—GUARANTEES YOU

1. Absolute satisfaction safeguarded by ample financial resources.
2. Unconditional warranty of perfect operating equipment.
3. Lowest upkeep and service expense.
4. Lowest prices in the industry.

Illustrated Bulletins and Price Lists Sent Free.

S. O. S. CORP.
1600 BROADWAY
NEW YORK, N. Y.

DA-LITE

SCREENS

8 Types
No Two Alike

REGARDLESS of the width of your house or the kind of light source you are using, you can insure best possible results with a new DALITE Screen made to meet your requirements.

Ask your dealer—or write direct to us.

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Chicago Illinois

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STUDIO AND THEATRE SOUND PICTURE ADVANCES CITED

(*Continued from page* 10)

conditions are not desirable for musical reproduction. The most desirable arrangement, he suggested, might be to use *two sound tracks* and *two complete reproducing systems* so that dialogue could be reproduced over a system similar to that now employed, and the music through a system utilizing an entirely different loudspeaker arrangement, preferably one that would diffuse the sound and spread the sources over a greater area so as to increase its reverberance.

For the present, however, Mr. Batsel said, the best results can be obtained by providing more satisfactory reverberation and good tonal characteristics on the recording stages in the studios. To this end, studio technicians were urged to adopt the known standards for producing more pleasing "tone design" which have been established with audiences over a great period of time in church buildings, concert halls and opera houses.

With the development of a skillful technique for adding sound effects, eliminating undesirable sounds from the original "takes," and other dubbing almost no feature picture is released today without more or less re-recording.

New RCA Sound Track

Several of the RCA engineers, in their papers, referred to the development of a radically new system of noiseless sound recording called "push-pull" or "double sound track" as an ideal one for making the original sound track.[1] The new "push-pull" system, they said, makes possible the complete elimination of ground and hissing noises, gives a greater range of volume shadings and overall fidelity of reproduction over the entire audible range of sound. In operation, the sound waves are halved into two separate but symmetrical sound tracks, one negative and the other positive, automatically eliminating the blank unused portion of the sound track which was previously responsible for the background noise. This means that in original "takes" the recordist does not have to take time out to make critical adjustments of a delicate noise reduction system. Also, in the re-recording process, the producer is enabled to vary the character of the sound in the final prints to suit the requirements of individual theatres.

Recent Important Improvements

Mr. Batsel enumerated some of the important recent developments toward the elimination of distortion which bring sound pictures nearer the ideal of realism and tone fidelity. These developments were covered in detail by RCA engineers in separate papers, but he summarized them as follows:

1. Development of film-moving mechanisms free from objectionable variations of speed, notably the magnetically-driven drum in the recorder, and the "rotary stabilizer" in the reproducer. Elimination of flutter caused by film gate construction and ripples produced by the sprocket holes.
2. Improvement of recorder optical system so that it is capable of satisfactorily recording a frequency range from 40 up to 10,000 cycles.
3. Improvement of amplifiers through development of new types of vacuum tubes, improved transformers and resistors.
4. New laboratory devices for analysis of causes of distortion so that they might be eliminated.
5. New types of microphones. These are of the velocity type, having a smoother response over a wider frequency range than previous types, and fulfill the requirement for a directional microphone having characteristics independent of frequency. In the development of these microphones there has also been considered some of the more fundamental factors essential for further improvement in sound recording.

[1]Described in detail elsewhere in this issue.—Ed.

L.U. 306 Retains I. A. Control

Local 306 voted overwhelmingly to retain I. A. control over its destinies, at a recent meeting presided over by President George E. Browne and Vice-president Harland Holmden, Cleveland, who has been in control of the union since July 7, 1933. Holmden read a report of I. A. stewardship to date, which revealed that the local was broke when the I. A. assumed control but now has $100,000 cash on hand.

A hearing on the N. Y. City wage scale promulgated by the NRA was to have been held June 4 in Washington. Details of this scale appear elsewhere in this issue.

ANNOUNCING

WINNERS IN THE MOTION PICTURE INDUSTRY 1934-35

Claudette Colbert	Best Actress
Clark Gable	Best Actor
Shirley Temple	Special Award
John Livadary	Best Sound Recording
Frank Capra	Best Director
Victor Milner	Best Cameraman
"It Happened One Night"	Best Picture
"La Cucaracha"	Best Short
"The Tortoise and the Hare"	Best Cartoon

Judge—
ACADEMY OF MOTION PICTURE ARTS AND SCIENCES

Claudette Colbert and Clark Gable in "It Happened One Night."

WINNER OF JOURNAL AWARD

P. A. SNELL

For the Outstanding Technical Paper Published During the Year.
JUDGE—SOCIETY OF MOTION PICTURE ENGINEERS

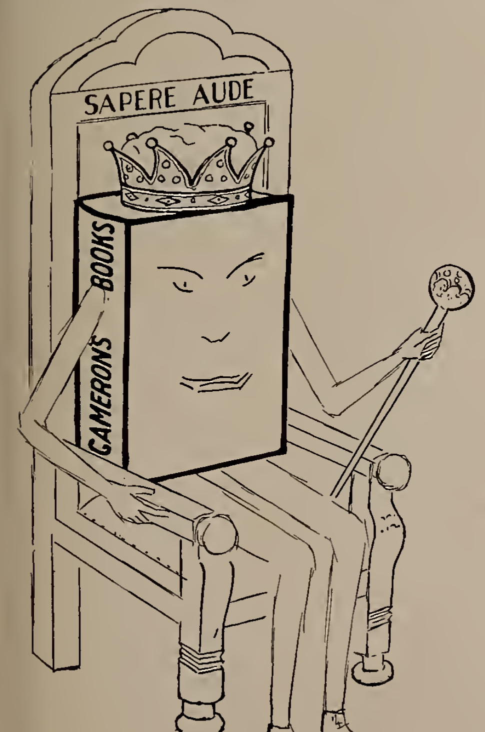
TEN BEST PICTURES

It Happened One Night
The Barretts of Wimpole Street
The House of Rothschild
One Night of Love
Little Women
The Thin Man
Viva Villa!
Dinner at Eight
Count of Monte Cristo
Berkeley Square

Judge—THE FILM DAILY (Critics Poll)

Shirley Temple—Special Award Winner.

AND OF COURSE—



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REVIEW NUMBER

MAY 1935

Foreword

It is highly significant that a specialized periodical developed to the craft and problems of the projectionist can flourish; and it is noteworthy that an enlarged and extensive issue of such a periodical can be launched on occasions of special interest to projectionists. Such happenings would have been unimaginable a scant twenty years ago; and it is a tribute to those who have consistently labored in the interests of the projectionists during the last two decades that such events should have come to pass.

The elements of strength of any group of projectionists are their careful training, their expert skill in the handling of the complicated optical and acoustic equipment of the theater, their pride in their craftsmanship, and the constructive aspects of their mutual association. Each and every one of these elements merits encouragement and respect. Without such support, projectionists may well encounter a succession of discouraging difficulties and disheartening setbacks. But given such support, projectionists may reasonably anticipate continued and increased respect, improved standing in the motion picture world, and the correspondingly increased financial returns which go to those who attain high standing through effort and enthusiasm.

Projectionists should never forget that, in addition to being the qualified manipulators of the specialized equipment of sound motion picture presentations, they are actually the stage managers of the motion picture theater, entrusted with a real responsibility for the maintenance of public interest in, and backing of, the theater. The best wishes of the farseeing members of the industry go to them in their tasks and in the ever-continued growth of the craftsmanship and professional standing of their group.

ALFRED N. GOLDSMITH

Browning, N. Y.

FRUITION

Testing Electric Circuits

By A. C. SCHROEDER

TESTING is done to find out what conditions do or do not exist in an electric circuit. It is done with electrical instruments rather than "looking" for the trouble, because there are difficulties which cannot be found by looking—they occur somewhere within the apparatus or in some remote corner into which we cannot get to see what has happened.

In other instances testing is restored to because it usually locates the seat of the trouble quickly, whereas if we were compelled to look through all of the parts that are in any one circuit, it would take considerable time, and when we finished we might find that the trouble is not in this circuit but elsewhere.

Do not assume that visual examination is of no value. A short inspection combined with the process of pulling and prying on leads, and so forth, will sometimes reveal the trouble in short order. In some instances visual inspection is required after the electrical tests have been made; at other times the two methods are used together. Placing the hand on a suspected wire or apparatus often gives an indication of trouble by the amount of heat that is present. This must be done carefully, otherwise a skin burn might result.

In order to know what kind of meter to use, what meter would be ruined if used on a certain test, or if the meter would ruin the part being tested, and also to interpret the results of the test, an understanding of Ohms-law is essential. This need not frighten anyone; it is simple and requires only a rudimentary knowledge of mathematics.

Ohms-law is simply a statement of the relation existing in a circuit between the voltage applied, the current flowing, and the resistance in that circuit. If any two of these values are known, the third one can be found either by multiplication or by division. When the current and the resistance are known, the voltage is found by multiplying the two known values. When the voltage and one of the others is known, the voltage is divided by the other known quantity. This relationship exists in all circuits no matter how large or how small the apparatus or the wiring may be.

From I. P. for Dec., 1931; Feb. and March, 1932

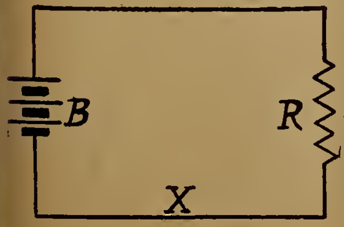

Figure 1

The current is the result of the voltage and the resistance. It cannot be changed unless the voltage, the resistance, or both the voltage and the resistance, are changed. A change of voltage or of resistance always causes a change in the current. If the voltage is increased and the resistance is increased proportionately, the current remains the same. If both are decreased proportionately, the current again remains as it was.

Let us consider a few examples in order to make this clear. In Figure 1 we have a battery, B, and a resistance, R, which are connected so as to form a closed circuit. For the first example we will assume that this is a small test circuit on the bench and that the connecting wires have no resistance. This assumption is never true, but the resistance of the wires in this case is very low and can be ignored.

The voltage of B is 10, the resistance of R is 5 ohms. If B is a storage battery in good condition, its resistance will be very small and can also be ignored. The current in such a circuit will be found by dividing 10 by 5, which shows that 2 amps. are flowing. A voltmeter across the battery will read 10. If the meter be put across R, it will also read 10. An ammeter inserted in the line at X will read 2 amps.

Placing the same resistance, which may be an electric light, at a point 100 feet away, we must use two connecting wires, each of which is 100 feet in length. The resistance of these two wires is 5 ohms and *cannot* be ignored, since it will affect the result a great deal. The total resistance in the circuit is now 10 ohms (5 ohms in R and 5 ohms in the wires). Ten divided by 10 gives us 1. Only 1 ampere is flowing in the circuit now. One ampere is not sufficient to light the lamp properly. Let us see what conditions have caused this.

Placing the voltmeter across the battery, we see that there still are 10 volts at this point. We place the meter across the resistance and get only 5 volts. Apparently some voltage has been lost between the battery and the resistance. Taking the voltage across the resistance, which is 5, and dividing by 5, the number of ohms, again gives us 1 amp. as the current.

To illustrate a different angle, we draw the circuit shown in Figure 2. R has been moved to the next battery, where it is connected by a wire having practically no resistance. The loop of wire extending from R to X and back to the battery is 200 feet long and has 5 ohms resistance, just as the two wires had in Figure 1 after R had been moved 100 feet from the battery. An ammeter will show a flow of 1 amp. A voltmeter across the battery shows 10 volts. The meter is now placed across R, and the reading is 5 volts as before.

One lead from the meter is then touched to point 2 at the lower end of the battery, and with the other lead placed on 3 at the far end of the resistance, a reading of 5 volts is obtained.

The drawing will show that we are measuring the voltage across the wire that connects the battery and the resistance, that is, around the 200-foot loop. It takes 5 volts of the battery potential to force the current through the loop of wire. We know that the resistance of the wire is 5 ohms. Dividing the voltage drop *in the wire* by the resistance *of the wire* gives us 1, which is the number of amperes flowing.

As the current remains constant so long as no change is made in the circuit and the battery is not discharged, then our answer in amps. must be 1, regardless of how the calculation is made; and right here we must watch our step. Notice the italics in the previous paragraph. To apply Ohms-law we must be very careful not to get the various parts of the circuit mixed up. Had we taken the voltage of the battery and divided it by the resistance of the long loop of wire, we should have had a wrong answer. Mistakes such as this are very easy to make when dealing with circuits that are more or less complicated, but this is no fault of the Ohms-law. The law always holds good, and when it seems as though it will not work in some cases, it is because we do not use it properly.

The voltage of the battery (Fig. 2), is also the voltage across that part of the circuit starting at 1, through the resistance, R, out on the long stretch of wire to X, and back again to point 2 at the other end of the battery. In applying Ohms-law, when we consider the voltage across the entire circuit we must also consider the resistance of exactly the same circuit.

Before passing on from Figure 2, let us make a different application of Ohms-

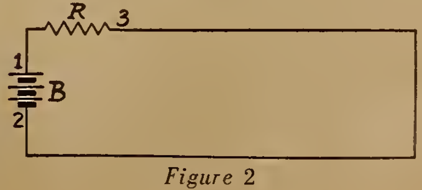

Figure 2

law. It is desirable to know what the resistance of the wire is from R to the point X. It would probably be 2.5 ohms, but this is not positively known. The voltmeter terminals are applied at 3 and at X, and the voltage is found to be 2.5, which, divided by 1, gives 2.5, the number of ohms in that part of the wire.

To measure the voltage in this part of the wire it is necessary to have a wire on the meter about 100 feet long to reach X. In the present problem this makes no difference, but there are some cases where that length of wire would give an erroneous reading. We will discuss that phase of the problem in connection with other circuits later on.

Assume that we have two vacuum tubes wired in parallel, the normal filament voltage being 4.5 and the current through each tube 1.6 amps., or a total of 3.2 amps. for both tubes. A rheostat is in series with the tubes so as to cut the voltage from 6 to that required by the filament. The source of current is a 12-volt storage battery. A difference of 6 volts exists between the battery voltage and the voltage we need across the circuit in the amplifier, so a resistance is used to consume the excess voltage. We desire to find out what value of resistance it will take to produce the 6-volt drop.

The unknown quantity is the resistance in ohms; the two known values are the voltage to be dropped, which is 6, and the current that is to flow through the additional resistance, 3.2 amps. Dividing 6 by 3.2 gives 1.875, the number of ohms required.

In practice, a resistance of 1.8 or 1.9 ohms would be used. The rheostat will take care of the difference caused by the fixed resistance being of a slightly different value. Figure 3 is a diagram of the circuit. Actually there would be a switch and a number of wires connected to other circuits in the amplifier, but these do not affect the filament current and we need not take them into consideration. R is the fixed resistance, RH is the rheostat, and the two resistances, T, represent the filaments of the vacuum tubes.

While we have the circuit in Figure 3 under discussion, let us see what occurs if one of the tubes should burn out. As it stands now, we do not know the resistance of the filaments nor the resistance of that portion of the rheostat which is in use. We know that the current through the rheostat must be 3.2 amps., and we know the rheostat must cause a drop of 1.5 volts, from 6 to that required by the tubes, which is 4.5 volts. 1.5 divided by 3.2 gives a figure very close to .469 ohms, the resistance being used in the rheostat. The filament resistance of one tube is found in the same manner—4.5 divided by 1.6, or 2.8 ohms.

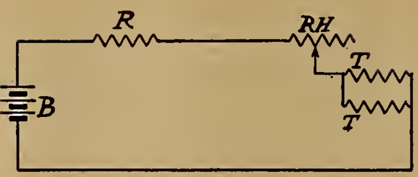

Figure 3

Possibly it isn't clear why we divide by 3.2 in one instance while in the other we divide by 1.6. The current through one tube will be 1.6 amps. when the voltage impressed on the filament is 4.5, consequently we must divide the voltage by 1.6. The rheostat is adjusted until the current through both tubes is 3.2 amps. This same current is also flowing through the rheostat, which causes a drop in the rheostat of 1.5 volts, so 1.5 is divided by 3.2 to find the number of ohms.

Having found the resistance of all the apparatus in the circuit we add them all together:—1.9 ohms in the fixed resistance, .47 ohms in the rheostat (.47 is close enough to the actual value, .469 ohms); and 2.8 ohms in the filament of the tube. The sum of all three resistances is 5.17 ohms. The resistance of the wires is negligible. Dividing the battery voltage, 12, by the total resistance in the circuit, 5.17, gives us a current of 2.3 amps. through one tube. This much current through a tube designed to carry only 1.6 amps. will very rapidly ruin it.

IN FIGURE 4 is shown a simple two-wire circuit. It is surprising how many things can happen in such a circuit and the different methods that can be used in testing it. The use to which this circuit is put often has a large bearing on the test and in interpreting the results thereof.

Assume that the drawing represents a line carrying 110 volts and that the end at A is connected to the source of supply. The wires at B go to the device that constitutes the load, but for the present we will assume that it has been disconnected by opening a switch. Near the end B are two fuses.

Both wires should be continuous from A to B, that is, if nothing is wrong. For the first test we place the leads from a test lamp across the terminals of the fuse block at the end nearest B. If the lamp lights, it is an indication that current is flowing through the lamp and that it *probably* is coming from A. This might sound queer, but the fact that the lamp lights when connected to the end of the line at B is not *positive* proof that the line is continuous.

The line could be broken, as at X in Figure 5, and if there is a circuit of some kind around the break, as shown by the dotted line, the lamp will light. It is true that such a condition is not likely to occur in a line such as we are discussing. It is not at all unlikely to happen in an amplifier or its associated apparatus, however, with the usual result of noisy operation or possibly one or more tubes working at a wrong voltage, etc. The unlikely condition is the one that stumps the man who does not consider all possibilities.

As a rule, it can be taken for granted that the current is coming from A when the test lamp lights. If any doubt exists (and it must be established if this is so), simply opening *both* sides of the circuit at A will establish the fact. If this causes the lamp to go out, it shows that A is the source of power; if the lamp remains lighted, the current must be coming from some other place.

Figure 6 shows how such a condition might occur. We have a line from A to B as before, but it is broken at X-X and two wires are brought down to C where they are connected to a different power supply.

Suppose that the lamp does not light. The next step will be to see that the test circuit is O. K. Place the test lamp across a circuit that is known to be in good condition. This can be done by testing across the fuses that connect to the projection room lights, the amplifier circuit, or somewhere in the circuit between the motor generator and the arc. If the projection room lights work, if the amplifier is lighted, or if the arc is lighted we know that these circuits are O. K. Should the test lamp light when put across any of these, it shows that our test circuit was in good shape and that the current was not getting to point B in this line.

If it is shown that the test circuit is at fault, we try another lamp, one that has been working somewhere, or we can take the lamp out of the test circuit and try it in a socket in which a light has been burning. If the lamp was in good condition, the trouble is either a broken wire, or the lamp was not screwed down in the socket.

Now that the test circuit is O. K., we again test at B (Fig. 6). Suppose that we still get no indication of current. The test terminals are then placed across the other end of the fuse block, the end farthest from B, and we find that the lamp lights here, which shows that the trouble is either in the fuses or in some part of the fuse block. One wire from the test lamp is then touched to C (Fig. 4), and the other wire to D. If the lamp does not light, it shows that the lower fuse is probably blown.

Ninety-nine times out of a 100 it will be the fuse; but we must remember that it is possible for the trouble to be in the fuse receptacle. If the lamp lights when this test is made, it shows that

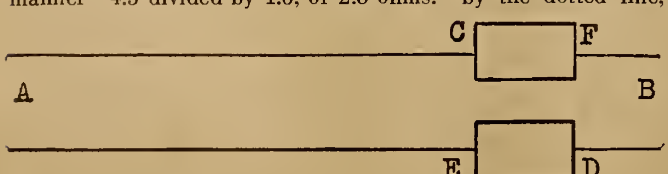

Figure 4

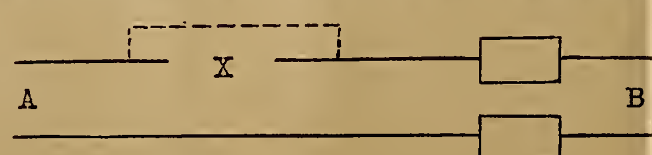

Figure 5

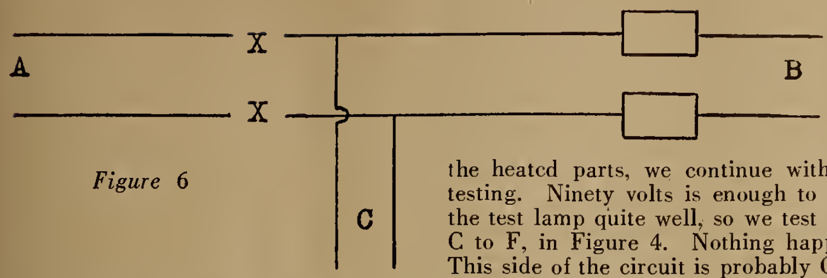

Figure 6

the lower fuse and the clips into which it fits are O. K., at least there is no open circuit, so the leads are touched to E and F. The results of this test are interpreted the same as the test from C to D.

Sometimes it is easier to locate the trouble by testing while the load is connected. Assume that the load connected to B in Figure 4 draws 100 amps. when everything is normal. At this particular time the apparatus will not function, so the switch is opened and the test lamp is placed across the end of the fuses at B, and the lamp lights, showing the fuses to be O. K. Since there are no other fuses between this point and the load, it is evident that something is wrong in some part of the apparatus or the wiring. It is convenient to start at the fuse block, so we close the switch, throwing the load back onto the line. Another test is made across the fuses at the end B, and still the lamp does not light.

Let us analyze this condition to see just what happens. Our test lamp lights when the load is not connected; but when the load is thrown on, the lamp goes out. A test is now made across the fuses on the side nearest A and the lamp lights even with the load connected. When the load is hooked onto the circuit, the voltage across the B end of the fuses drops so low that the lamp will not light, which means that the voltage probably drops to about 20, possibly less. We found the voltage across the other end of the fuses still was 110, so the trouble must be somewhere in the fuses or in the fuse block.

Subtracting 20, the voltage at B, from 110, the voltage at the other end of the fuses, gives 90, the voltage-drop in the fuse block.

Under these conditions there are about 1800 watts of energy consumed due to the resistance somewhere in the fuse block. This is approximately three times as much as an electric flatiron uses, so it stands to reason that a great deal of heat will be produced. This will be discovered very quickly—in fact, if the circuit is left in such a condition, the fuses will blow due to the heat. The point is that heat is generated and can be found quickly by touching the parts—carefully, of course, as they may be very hot. It should be kept in mind that cartridge fuses having round ends that fit into the clips often run quite warm when 50 to 60 amps. are taken from the line. That is why fuses of larger capacity are made with the knife-type contacts.

Since we are discussing principles, and also because we cannot locate the exact point of the trouble by looking for the heated parts, we continue with the testing. Ninety volts is enough to light the test lamp quite well, so we test from C to F, in Figure 4. Nothing happens. This side of the circuit is probably O. K. Then the test is made from E to D and the lamp lights, not to full brilliance, but still quite brightly. Evidently this must be where the trouble is, because normally there should be no drop in voltage across these two points.

The test leads can now be placed on the ends of the fuse, as at No. 4 in Fig. 7. The lamp probably will not light, since it is unlikely that a high resistance will develop in the fuse. Such a condition would cause the fuse to burn-out almost immediately.

Testing as shown at No. 5 (Fig. 7) from the terminal screw to the end of the fuse, quickly shows on which end the trouble is, since the lamp is now across all the parts at this end of the block. If the lamp does not light at one end, the test is repeated at the other as a check; and if it lights, we proceed to dig deeper.

Test from the clip to the fuse, No. 6 (Fig. 7). If the lamp lights, we have found the trouble—a poor contact between the fuse and the clip. Continuing, one lead is placed on the part to which the wire is fastened and the other lead on the bare wire, as at No. 7 in Fig. 7. High resistance caused by a loose wire or corroded wire is found by this test.

No. 8 (Fig. 7) shows the remaining point to be tested, that is, if high resistance is present between the clip and the part next to it having the screw in it under which the wire is fastened.

By this time it should be apparent that the idea is to get the test lamp across the part of the circuit in which the high resistance exists. The *exact* location can be found in this manner. Of course, it is not logical to start the search by testing every small part of the circuit, step by step. In a large and complicated circuit such a procedure would take a long time. A large portion of the wiring, etc., is eliminated in the first few tests.

Let us go through some of the steps again, without going into details. The test lamp across B in Figure 4 showed a presence of voltage. Next, the load was thrown on and there was no voltage at this point, that is, not enough to light the lamp. Testing across A showed that the full line voltage was present. We have made three tests and have eliminated everything on the line side of the fuses and *probably* everything from the fuse to the device itself.

One more test showed that the upper fuse and the clips were not the seat of the trouble. We proceed to the lower fuse and it is evident that the trouble is right around this portion of the equipment. It is possible that the *exact* seat of the trouble has not been found after all the tests have been made as set forth. In such a case we must test across each piece of metal that was in the circuit when we made the test shown at No. 5 in Fig. 7.

It sometimes happens that cracks and seams occur in manufactured articles. Suppose that one of the parts is cracked, possibly on the under side where it cannot be seen. One test lead is put on one end of the part, and the other lead on the opposite end. The lamp lights if the part is defective.

It is seldom that all the tests outlined here would have to be made, the trouble being found after a few tests are made.

HAVING discussed thoroughly the testing of a line and a fuse block, we now realize that testing apparatus must be suitable for the circuit to be tested. Often the testing device can be adapted to the circuit. An example of

(*Continued on page* 39)

——FIGURE 7——

Gorgeous effect work in Radio City Music Hall (N. Y.) through application of ultra-violet light process

Projection Effect Work With Ultra-Violet Light

By A. STROBL and ROBERT L. ZAHOUR

MORE than three hundred years ago, the Italian scientist Balmain discovered the photo-chemical property of certain substances to absorb energy from visible light sources, and produce in themselves a luminous glow when observed in the dark. Further study of light sources, capable of energizing these substances, revealed that the longer wave-lengths of the ultra-violet invisible radiations (3,200 A to 4,200 A) are transformed by certain substances into longer waves of a length found in the visible spectrum.

This phenomenal transformation varies in different materials, making available a variety of luminous colors. Pigments extracted from these substances are commonly called "ultra-violet paints," and because of their ability to glow they are said to be "luminescent" when exposed to the ultra-violet radiations.

Two kinds of paints have been discovered for producing practical luminous effects—namely, fluorescent and phosphorescent. Fluorescent pigments are those which become luminous when subjected to ultra-violet radiations. These paints are available in nearly all colors of the rainbow. Phosphorescent paints will emit a self-luminous glow for some period after the ultra-violet has been withdrawn. This latter kind of paint is available in several colors. The phenomenal glowing characteristics of each of these two types of paints permit one to obtain two distinctly different luminous effects when used jointly in a single composite design.

Since most of the early uses of ultra-violet paints were confined to stage effects, the arc spotlight, equipped with suitable glass filters to screen out practically all of the visible light, was used satisfactorily to project invisible ultra-violet radiations onto the specially treated scenes and costumes. Because of the abundance of ultra-violet generated, the arc projector still is employed for this purpose and particularly where coverage of large production scenes at long beam throws is necessary.

An outgrowth of the stage effects brought about uses for ultra-violet paints in advertising posters, small dual-scene paintings, and in miniature design novelties. For these applications, light-tight projectors equipped with dense blue heat-resisting glass filters and ordinary high-wattage Mazda lamps, were found more convenient than arc units. However, due to the proportionately small amounts of ultra-violet liberated by Mazda lamps compared with visible light, only medium-density filters can be used for screening out the visible radiations. For some applications, the small percentage of visible light which escapes from these modified equipments is objectionable, which in other cases it is an asset.

"Black Bulb" Mercury Lamps

Continued growth in the application of ultra-violet effects has led to the development of dense blue grass mercury vapor tubes, and finally, the "black bulb" mercury vapor lamps. Since the visible light from these sources consists of, chiefly, blue-green mercury spectrum lines, the thickness of the dense blue filter glass in the tube of "black bulb" is not as great as in the screens employed for masking carbon arcs or high-wattage Mazda lamps. Consequently, more ultra-violet is transmitted for useful purposes.

The mercury vapor tube and its accessories for operation is essentially the same as the standard Cooper-Hewitt lamp, except that the tube is made of a dense blue ultra-violet filter glass.

The "black bulb" ultra-violet lamp is similar to the ultra-violet health lamp in construction details and operating characteristics, but is provided with a special dense purple glass bulb which absorbs practically all of the visible light, yet transmits a high percentage of the ultra-violet.

Ziegfeld's Follies of 1922 brought forth a gasp of admiration from the audience as the stage lights were dimmed to black out, and the pale lace gowns turned luminously brilliant and many-hued. The gowns were treated with vari-colored luminous painted designs which were practically invisible to the audience under the stage illumination, but beautifully luminous in the presence of ultra-violet furnished from concealed footlights containing quartz-mercury lamps with special glass filters. Many theatrical productions since have enhanced the beauty of their settings and in some instances, effected dual-scenes on the same curtain drop, through the use of luminous paints.

At the Century of Progress, Chicago, several exhibitors feature posters showing two and three different scenes through the combined use of non-luminous, fluorescent, and phosphorescent paints. In one setting, the wall paper of a room exhibits a simple conventional design of cross-section lines when viewed in ordinary light. Under the ultra-violet radiation, this simple design is transformed into a beautiful, luminously colored sea garden of various fish and flowering plants. The ceiling changes

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to a sky by night, studded with luminous stars.

Likewise, another exhibitor hangs a large Spanish shawl in a prominent position of a space easily darkened. The edges of this shawl are beautifully marked and under ordinary light the center remains blank. In the presence of the ultra-violet, the edges of the shawl take on a luminous irridescent effect of sailboats, waves, and fish. The company monogram of exhibitor, appears brilliantly in the heretofore blank center.

Varied Applications

Since the effectiveness of these displays depends largely on the maximum brightness contrast between the untreated areas, which remain dark, and the luminous designs, it is extremely essential that visible light be eliminated. A small quantity of stray light is sufficient to illuminate the dark background, thereby reducing this contrast and consequently weakening the effect.

With refinements and modifications of present available ultra-violet lighting equipments, and with ultra-violet paints now satisfactorily developed, the art of luminescent effect lighting offers interesting possibilities. Ultra-violet light sources may be concealed in wall urns, indirect floor pedestals, or suspended domes, or in covers, for the purpose of energizing ultra-violet painted scenes or designs in framed pictures, or on the side walls and ceilings.

One of the most attractive and intriguing creations is that of a dual-scene painted on the upper side walls and ceiling of a night club resort or theatre. With the skill of experienced artists, a simple design is painted on these areas in non-luminous or ordinary paints. A second scene, applied with fluorescent paints, is carefully incorporated in the first design, and combined with these a third view is concealed with phosphorescent paints. Under artificial or natural light, the first design will take prominence. Under the ultra-violet the combination fluorescent and phosphorescent scene will luminously stand out in the dark. On withdrawing the rays, the phosphorescent painted view alone remains visibly luminous.

Does the H. I. Arc Tail Flame Contribute to Screen Light?

DOES the tail flame of a high-intensity arc contribute to screen illumination?, is a question which has served to uncover sharp differences of opinion among projectionists. The Handbook of the National Carbon Co., in discussing this arc, states:

"The light from the high-intensity arc comes from two distinct sources: the crater of the positive carbon and the tail flame. The light from the tail flame represents about 30 per cent of the total light emitted from the arc, but, since it cannot be focussed within the dimensions of the aperture plate and any appreciable portion of it utilized by the optical system, the projectionist is interested only in the crater light . . .

"The whiteness and brilliancy of this crater light . . . evidently has its source in something more than the solid tip of incandescent carbon.

"This intensified light can be conceived as coming from a portion of the luminous gases of the tail flame, compressed in the crater of the positive carbon by the negative arc stream and thus augmenting the light from the incandescent carbon tip. This explanation may not accord with physical fact, but it aids the imagination in visualizing a reason for the remarkably high intrinsic brilliancy of the high-intensity carbon arc as compared with other sources of illumination.

"The fact that the quantity and quality of light from the high-intensity arc, operated at a given current, varies greatly with the manner in which the arc stream from the negative carbon impinges upon the flame of the positive, indicates that some condition obtains which is in a measure equivalent to that described."

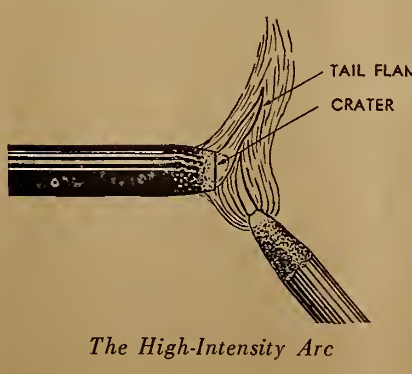
That the answer to this question lies in a clear-cut definition of terms is confirmed in the appended statement by E. R. Geib, manager of the Arc Department of the National Carbon Co.:

"The answer to the question—'Does or does not the tail flame contribute in any way to screen illumination . . .?' is largely dependent on the definition of the term 'tail flame.' The luminous gases of the tail flame emanate from the positive crater of the high-intensity carbon arc. Prior to leaving the crater, these gases may be considered as having been compressed in the crater cup by the force of the negative arc stream, and these compressed gases in the crater cup of the positive carbon are the principal source of light which is in focus with the optical system and, therefore, a source of illumination on the screen.

"If the tail flame is defined as comprising only that portion of this stream of luminous gases coming from the crater of the positive carbon (which lies outside of the conical space defined by the periphery of the condenser lens, or reflecting mirror) and the crater of the positive carbon, it does not contribute at all to screen illumination.

"Most of the screen illumination comes from the compressed gases in the crater cup above described, supplemented to a greater or lesser degree by the light from the incandescent carbon within the crater area and that from the luminous gases which have escaped from the crater cup, but are still within the conical space which the optical system is capable of focusing on the aperture plate.

"It is in this sense that the statement is made on page 25 of the National Carbon Handbook—' . . . . the projectionist is interested only in the crater light.' Considering the tail flame as above defined, there should be no difficulty in interpreting the description of the high-intensity arc given in the Handbook."



The High-Intensity Arc

From I.P., March, 1934

Switches

By SIDNEY WEIN

THE various switches are among the most important elements of equipment in a projection room. Switches that are faulty in design or manufacture, or that have been worn to an extreme degree, often prove troublesome, and in several instances have been known to stop a show. All projectionists are somewhat vaguely aware of the importance of switches, but very few understand just why a switch burns out.

Incidentally, switches are never replaced until they *do* burn out, thus the responsibility of the projectionist for their care is therefor greater.

Arc Switch Burn-Out

The arc lamp switch is the one most likely to burn out, the reasons for which being: lugs not clamped tightly enough on the binding posts, wires not soldered properly into the lugs, and excess heat, caused by the wrong size wire or the wrong size switch. Excessive heat takes the temper out of the spring washers on the switch, inducing undue arcing in the hinge part of the switch and inevitably causing the latter to melt. This can happen when the wire or switch is below the proper carrying-capacity for the amperage being used in the arc.

This writer recalls one instance of where a 100-ampere switch was used on a certain hi-low lamp, which was replaced with a high-intensity lamp using 130 amperes. Although the projectionists requested the proper size switches at the time the change was made, and have renewed this request many times since, the 100-ampere switches still are in service. The burn-out on this job probably will occur when the theatre is filled with cash customers.

Another not infrequent cause of a burn-out is the pleasure experienced by some projectionists in seeing the long flash of

(*Continued on next page*)

fire that issues from the switch-box when the switch is pulled out very slowly as the light is killed. (The writer didn't believe this possible, either, until he actually witnessed it.)

For long life, a switch should be the right size for safely carrying the amount of amperage used, and all wires in the circuit also should be of the proper carrying-capacity. It is important, of course, that all contacts should be as tight as possible. A little grease or vaseline on all working parts, such as the hinge and fork parts, prevents and absorbs arcing. Be sure that the spring washers have not lost their tension, and there be any doubt about it, replace the washers immediately. Proper tension is essential in the fork part of the switch, at the point where the blade fits in to make the contact, a lack of which tension causes undue arcing. Last, but certainly not least be sure to pull out the switch *with a snap* when killing the arc. Remove the pitting on the blades with a fine file or with emery cloth.

Regular inspection and a little care will prevent switches from burning out under ordinary operating conditions. Should an arc lamp or motor switch burn out during a show, the best means to overcome the difficulty quickly is to connect the wires straight across, just as though there were no switch—the positive being connected to the positive, and the negative to the negative. After tapping the connections, the main switches on the panel board may be used. This advice is directed to those projectionists who work in theatres where there are no spare switches on hand—and there are innumerable such theatres.

Repair Work by Projectionists

By JAMES J. FINN

THERE has been widespread discussion within the craft relative to the limits of the projectionist's responsibility in keeping the projector mechanism in good running order through the medium of effecting repairs. Opinion varies all the way from the entremely narrow view that the projectionist should do nothing but attend the projector, to that which sustains the opinion that provision be made in the projection room for the inclusion of a machine shop in which all minor and certain major repairs could be made.

One can adopt a sensible attitude in the matter, without prejudice, to either school of opinion. All fair-minded projectionists will concede the justice of the viewpoint that any work done to keep the show going falls within the limits of their responsibilities.

If projectionists desire general recognition of the importance of their positions in the theatre, and this writer holds that such recognition has been too long delayed, they must assume certain responsibilities which are the inevitable accompaniment of such recognition.

The heart of the projection room is the projector, the anatomy of which should be thoroughly understood by every projectionist. Careful consideration of the problem of projection room upkeep leads one to the conclusion that a first-class projectionist should be able to make the following repairs:

1. Replace both upper and lower sprockets and sprocket pad rollers.
2. Put on film trap door lever spring.
3. Replace all parts on the film trap assembly, which includes the intermittent film guide assembly.
4. Replace the automatic fire shutter lift assembly.
5. Replace governor weight links on the film gate trap assembly. On the new Simplex projector with rear shutter a little difficulty may be experienced in effecting this change, but it can be done.
6. Replace the upper and lower magazine fire rollers.
7. Replace film stripper (S-508-D).
8. Change intermediate gear and shaft (G-1, including G-12, the formica intermediate gear and plate assembly).
9. Replace main driving gear (G-112-G).
10. Remove and set shutter.
11. Remove and replace the intermittent movement.
12. Keep scrupulously clean the entire mechanism, and positively keep the fire rollers rolling. To help prevent fire and sharply reduce scratch marks.

From I.P., August, 1932

Halation Overcome By Use of Gray-Back Film Stock

Gray Base Film

Clear Base Film

Glass Plate

HALATION is the blur or halo of light which is sometimes seen in photographs around the edges of bright highlights, and although it may be present throughout the area of the highlight, where it has a deleterious effect on the quality, it is usually noticed only when the blur of light extends into the dark area surrounding the highlight.

In most cases halation is undesirable because it tends to destroy detail, and this is particularly true in the case of the motion picture because of the high degree of magnification on the screen.

From I. P. for November, 1931

The above group of three illustrations show how halation was overcome. The right-hand picture was made on a plate and shows the halation rings; the other two pictures were made on super-sensitive panchromatic negative films having the same emulsion, but coated in one case on a clear base and in the other on a gray base. The exposures were equal and the negatives were processed together, receiving identical treatments. The prints show very distinctly the effect of the gray base in reducing the spread of light around the edges of the image.

. . . AND ITS USES

By D. C. McGALLIARD

PROBABLY no technical term in sound motion picture work is so frequently used and so little understood by the non-technical man as is the unit by which sound intensity is measured—the decibel. To the technical men, accustomed to electrical units and mathematics, the term presents little difficulty, but to others it is apt to be confusing, because of their unfamiliarity with it.

The word *decibel* (abbreviated "db") was formed by combining "deci," meaning one-tenth, with "bel," the fundamental unit named in honor of Dr. Alexander Bell, inventor of the telephone. It meets the need for a unit by means of which one amount of energy either in the form of electricity or sound, can be compared with another. In making such a comparison we could say, for instance, that one energy is twice as great, ten times, a thousand times, or a hundred million times as great as another. Such large numbers are obviously inconvenient to use. For instance, the energy of the loudest sound the human ear can tolerate is greater than the energy of the faintest sound the ear can detect by several million times. A more simple system of working with these large numbers is therefore desirable. The decibel furnishes such a system.

Response of the Ear

Before discussing the matter further, it will be helpful to consider briefly how the ear responds to sounds of different intensities. The reason for the peculiar ability of the ear to handle wide ranges of sound energy is that the impression of intensity is, fortunately, not directly proportional to the amount of sound energy reaching the ear. What is meant by this can perhaps best be illustrated by considering two glass water tumblers of about the same capacity, one the conventional cylindrical tumbler, the other shaped like a funnel or an inverted cone. If we fill these tumblers with water a spoonful at a time, the level of the water in the cylindrical one will rise by the same amount each time a spoonful is added. The level of the water in the funnel-shaped tumbler, however, will rise rapidly at first, but as it becomes more nearly filled the increase in level resulting from the addition of a spoonful can scarcely be noticed.

The human ear responds to sound in much the same way as the water level in the funnel-shaped tumbler does to water. As the sound energy is increased in equal amounts, the added sensation of intensity (loudness) resulting from these increases becomes less and less. If, however, each time the sound energy is changed it is increased by the same percentage of its previous value, the result will be equal increases in the sensation, that is, it will appear to get louder in equal steps.

This is indeed a wise provision of nature since it makes the ear sensitive to weak sounds and at the same time protects it from the loud sounds. It is important that this principle be constantly kept in mind, as it will be of considerable aid in obtaining a clear understanding of the subject.

Figuring Power Ratios

Without going into the mathematics of the subject, let us examine the numbers in Table 1. It is very evident that there is a definite relation between these figures. Those in Column B obviously represent the number of times the number 10 must be multiplied by itself to give the larger figures shown in Column A. The figures in Column C are ten times the corresponding figures in Column B. Since there is this definite relation between Column B or C and Column A, evidently we can make unnecessary the handling of the large numbers shown in Column A if we use instead the figures in Column B or C.

If now we consider Column A, B and C not as simple figures but as power ratios, bels and decibels, respectively, the relationship involved is apparent. By "power ratio" we mean the number of times the larger of the two powers being compared is greater than the smaller. Thus, if we are comparing a power of 2 watts with one of 20 watts, the power ratio is $\frac{20}{2} = 10$.

Aside from avoiding the handling of large numbers, there is another advantage, perhaps even more important, in using bels or decibels as in Columns B or C instead of power ratios as in Column A. In combining two power ratios, we must multiply or divide them, whereas the corresponding bels or decibels need only be added or subtracted.

For example, if one amplifier increases the sound energy 100 times and a second amplifier takes the output from the first one and increases it 10,000 times, the total increase has been 100 x 10,000, or 1,000,000 times. From the table we see that power ratios of 100, 10,000, and 1,000,000 correspond, respectively, to 20, 40, and 60 decibels. It is evident therefore that the total increase could have been figured much easier by simply adding the decibels corresponding to 100 and 10,000 (20 + 40 = 60) and then referring to Column A for the answer.

TABLE 1

Column A (Ratios)	*Column B* (Bels)	*Column C* (Decibels)
1	0	0
10	1	10
100	2	20
1,000	3	30
10,000	4	40
100,000	5	50
1,000,000	6	60

Unfortunately, in actual practice power ratios do not often work out to round figures such as 100 or 10,000 as used in the example given; they are much more likely to be uneven figures, such as 96 or 9,585. The advantages of using decibels are usually much greater than would appear from the example given, and by their use we are enabled to greatly simplify many calculations which would otherwise be very tedious.

There are two principal uses of the decibel:

1. To compare one sound intensity with another. For instance, if the energy of one sound is one hundred times as great as another, we say that the first sound is 2 bels, or 20 decibels, greater than the second. Thus, if the output of an amplifier is 6 watts, while the input is .06 watt, a power ratio of $\frac{6}{.06}$, or 100, we say that the amplification, or "gain" of the amplifier, is 20 decibels.

2. To measure the absolute value of sound energy by comparing it with some generally accepted standard energy value, either implied or expressed.

For purposes of comparison, acoustic experts usually refer sound intensities to "minimum audibility" (or "threshold of hearing," as it is sometimes called) which may be defined as the weakest sound which can be heard under absolutely quiet conditions. The power of such a weak sound is unbelievably small, being of the order of only a ten thousand millionth of a microwatt (a microwatt is a millionth of a watt),—another indication of the sensitivity of the ear. Thus, when the acoustic engineer refers to a sound as having an intensity of 50 decibels, the statement is actually incomplete, it should be said that the intensity is "50 db. above minimum audibility," or "50 db. above threshold."

"Minimum audibility" is much too small to be used as a reference intensity for relatively loud sounds,

From I.P., July, 1933

TABLE 2

Power Ratios	*Decibels*
1.25	1
1.6	2
2.0	3
2.5	4
3.2	5
4.0	6
5.0	7
6.3	8
8.	9
10.	10
100.	20
1,000.	30

such as those coming from the ordinary loudspeaker. Another reference intensity generally known as "zero level" has, therefore, been generally adopted by communication and sound engineers. An idea of the intensity of sound at "zero level" may be had if it is remembered that speech from a telephone receiver held tightly against the ear is about zero level when it is just too loud to be comfortable.

Engineers have agreed that, expressed in electrical power, this "zero level" should be taken as .006 watt. Thus, compared with zero level of .006 watt, the 6-watt output of the amplifier mentioned under (1) preceding would correspond to

a power ratio of $\frac{6}{.006}$, or a ratio of 1,000.

From the table it is seen that this ratio represents 30 decibels. Hence it is said that the output level of the amplifier is "30 decibels above zero level" or, simply, "30 decibels." Just as room temperature is commonly expressed as, say "70 degrees" without specifying that it is "70 degrees *above zero*," engineers commonly refer to the output of an amplifier as being, say, "30 decibels" without specifying that they mean "30 decibels *above zero level.*"

"Output Level" and "Gain"

Care should be taken not to confuse the "output level" of an amplifier with its "gain" referred to under (1) above. Each is commonly expressed in decibels, although, as explained, the output level should, strictly speaking, be expressed as "decibels above zero level." Thus, while the *output level* of this amplifier is 30 decibels (above zero level), its *gain* is only 20 decibels, as figured above. This will be more readily understood when it is considered that the input (.06 watt) is already 10 decibles above zero level. This is figured from

the power ratio of $\frac{.06 \text{ watt}}{\text{zero level}}$ or $\frac{.06}{.006}$

or 10 which, from the table, corresponds to 10 decibels. If the input of 10 decibels above zero level be increased by the 20-decibel gain of the amplifier, the output level will, of course, be 30 decibels above zero level. This is also in accordance with what we said previously about the addition and subtraction of decibels.

Table 2 shows the approximate power ratios corresponding to from 1 to 30 decibels. There are two convenient relations to remember in dealing with decibels. The first is that ten decibels correspond *exactly* to a tenfold change in power. The second is that in order to make a sound louder by 3 decibels it is necessary to approximately double its power. What this means can be more easily pictured when you consider that if the Niagara Falls power plant output were in the form of sound energy, it would be necessary to construct another power plant of the same capacity in order to increase the sound output by 3 decibels. In the same way for 6 decibels increase, the power would have to be about four times as great, for 9 decibels about eight times as great, and so on.

One cannot learn to drive an automobile by reading an instruction book. The same is true in studying the use of the decibel; it is necessary to actually apply the principles outlined to specific problems before they will be thoroughly understood. It is suggested, therefore, that the reader take advantage of any opportunities which may arise to make practical applications of the tables and explanations given. A little practice along these lines will convince him that the decibel is an extremely simple and useful unit.

Strike Now— FOR THE FUTURE

By Chauncey Greene

DR. GEORGE A. DORSEY, who the writer sincerely hopes is a learned scholar, once wrote a book entitled, "Why We Behave Like Human Beings." The basic theory underlying *why* we act like human beings (in our rational, and therefore strange, interludes) is doubtless interesting, but the practical man can seldom be induced to delve deeply into the fundamentals, preferring rather to view the net result, fix it in his memory, and be off on the trail of another net result.

Assuming, then, that we do act like human beings, one of the common failings of all humans is to think that the present situation, whatever it may at the moment be, will continue indefinitely. We thought so about the silent picture days, even after we had seen and heard DeForest's Phonofilm. We thought so about Anaconda Copper and Warner Brothers and Cities Service in 1929. We are prone to think so about the present state of our own industry, wherein the exhibitor, himself a human being (for confirmation send a stamped self-addressed envelope to Ripley) is in the well-known rut and his vocabulary is limited to one word, "Cut," with the fader way up until one longs to be his barber just once.

Excellence of performance means absolutely nothing. If the picture is a jumping-jack and ten cents will steady it, "Let it jump," says the exhib., unless someone else will spend the brace of nickles. If Norma Shearer sounds like a St. Bernard snoring in a cistern, what cares the exhibitor? He's saving money. Oh, yeah?

But let us not delude ourselves into thinking that this state of affairs is to last forever. Already the warnings are coming through in the form of improvements in the art—such as extended frequency range recordings. These, of course, sound little better than the old recordings when played over our present channels, but make no mistake, one of these days some smart exhib. (there must be *one* left) in your community, having played successively if not successfully with the bulls, the bears, and the jackasses, will suddenly get an idea to attend to business and make the necessary changes in his channels. The public will react, let us not be fooled about that, either, unless the exhibitor is chump enough to try to combine high-fidelity sound with low-fidelity projection. The competition will wake up, exchange its bellyache for a headache, commence to wonder what it's all about (will never find out, of course; if it did the shock would be fatal) and another typical stampede for which this cockeyed industry is famous will get under way. Those who prepare will profit.

Years ago a friend of the writer was preparing to forsake the ancestral acreage for the big city. Naturally he received a great deal of advice from the local sages, but one old Swede contributed the gem when he said: "Now Yens, ven you get to de big city remember yust two tang. Look dumb and be smart." At the present time, with industry at a standstill (Oct., 1932) we see many of the public service corporations engaged in reorganizing, rebuilding and in some cases expanding. It *looks* dumb, but maybe they are being smart. They are getting their buildings and facilities now for a fraction of their cost ten years hence, and when they need them they will have them.

Perhaps *now* would be a very good time for the projectionist to take inventory, overhaul and reorganize. We might find a surprising amount of deterioration. Replacements and additions to our stock of knowledge and skill will cost much less now than they will later when the need for them will be more acutely felt than at present; and when we suddenly do need them we will have them.

Look dumb—but be smart!

From I. P., Oct., 1932

★ ★ ★ Light *and* Lenses ★ ★ ★

By VICTOR WELMAN

THE theory of light changes almost from month to month and it requires constant reading to keep up with the procession. It is safe to say that no ordinary reader can keep up with these developments. The laws governing lens action, however, are well established and have been for many years. The principles to be outlined here can be found in a book[1] published in 1897 and which I studied in 1900—31 years ago. These dates should not surprise anyone, because the fundamental law governing the action of various shaped lenses were promulgated by Huygens about 1670, from which we can understand that it is not by any manner of means a recent development.

I cite the antiquity of this principle only to emphasize how unnecessary has been the widespread misunderstanding of lens action in the minds of many of those working with them, particularly among members of our own profession and, unfortunately, in most of the books published for popular study.

Figure 1 is a classic illustration to be found in almost all our books as illustrative of the course of light waves in projection optics. This drawing is the source of most of the misunderstanding current on lenses. It is what can be properly termed a shorthand drawing—telling the true story if one knows how to read it. In its original location in a textbook, following the explanation of the Huygens construction, it is clear enough; but when lifted into the popular books without proper explanation it does not tell a true story.

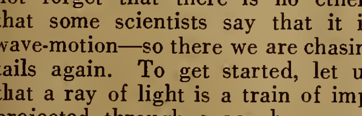
Now let's get into the subject. We'll try not to be logical—which means that we shall try to make it interesting. It has been my experience that a logical presentation of a subject dried it out.

What is light? I answer, "I don't know." Dr. Miller doesn't know; nor Dr. Michaelson. Even Einstein doesn't know. So, why should we worry about it?

For purposes of discussing light in lenses it is customary to consider light as a wave-motion in the ether; but do not forget that there is no ether and that some scientists say that it is not wave-motion—so there we are chasing our tails again. To get started, let us say that a ray of light is a train of impulses projected through space by an excited electron. This train of impulses obeys certain laws—and it is a couple of these laws in which we are interested.

[1]"Theory of Physics" by Ames.

From I. P., February and March, 1932

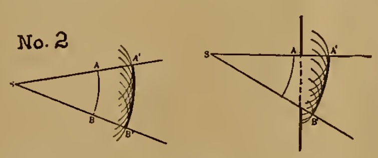


No. 1

How big is a ray of light?

We get into the habit of thinking of a ray of light as we do of a pencil line on paper, and we know, of course, that a ray of light is commonly expressed in this fashion. But it is not *a* ray but multiple rays—a million, perhaps. An electron is about a hundred-millionths of a millionth-of-an-inch in diameter. If one of these electrons is vibrating at such an amplitude that the resultant wave can be seen as light, hundreds of these waves could ride in a tube the size of a human hair and still leave ample elbow room. So, a line on a piece of paper represents not *one* ray but millions of rays of many frequencies which can be separated into their various frequencies, just as a filter can separate radio waves of various frequencies.

Huygens suggested in 1670 that light waves emitted from a point source of light advanced in all directions, and that if a surface is drawn through all the points of vibrations in the same phase, this surface will be a wave-front and the direction this front is advancing is a *ray* (what's this? . . . a ray of light is a direction *only* and hasn't any size



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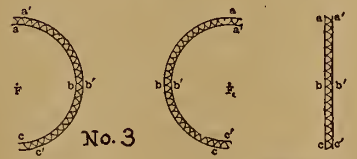

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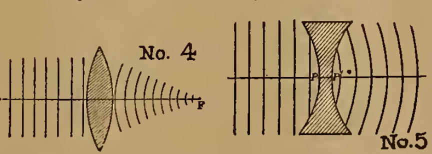


No. 4 No. 5

at all. That's even smaller than I said it was).

Now, Huygens says further that every point in that wave-front acts as a propagator of wave energy and starts a new wave-front, so that if we deal with wave-fronts and *not with rays*, which are directions only, we can predict just what will happen when light passes through lenses.

Now our drawing (Fig. 1), starts to take on meaning. It never did, in the original, intend to show the course of light rays but an envelope containing some wave-fronts.

Figure 2 illustrates the principle. Take a wave-front at AB. Each point on that front propagates a new front, and if we draw a line through similar points on each of these smaller wave-fronts, we get a new wave-front A′B′. Now, when a wave-front goes through a hole we know from experience that it does not cut-off sharply around the edges but the small wave-fronts lap around the edges, although the main front passes on in its original direction.

Wave Direction

If these wave-fronts are getting larger, they are called *diverging waves.* If they are getting smaller, they are called *converging waves.* If they are progressing in a plane, they are called *plane waves.*

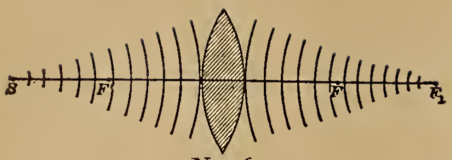
Now, light travels in the air at one velocity, but slows down when traveling through glass. In light coming from the sun the wave-front has a radius of 90,000,000 miles. A small arc of a circle of that diameter would be, as far as we on earth are concerned, a straight line and those waves come to us as plane waves.

Consider in this drawing (Fig. 4), a plane wave-front approaching a bi-convex lens. This wave-front hits the glass in the middle of the lens and that part of the wave slows down; as each part of the front hits the glass it slows down. Then the upper end of the wave-front gets out into the air and speeds up again. That part still in the glass holds back until it is all out, and the front is now converging and comes to a point which is called the *principal focus* of the lens.

With a concave lens, the ends of the wave-front are slowed up first as they hit the glass, the belly speeds up first when it gets through the glass ahead of the ends, and a diverging wave emerges (Fig. 5). Suppose the one face of this lens were flat: it can be seen in the drawing that a diverging wave still would come out of the lens, but it would not be diverging so rapidly.

By the way, where is the focal point of this lens? We described the focal point of the other lens as the point where plane waves were brought to a point, but here these plane waves do not come to a point. This is a negative lens, and the focus is on the opposite side of the lens from which the rays emerge and is called a *virtual focus,* as distinguished from the *real focus* of the other lens.

I said that wave-fronts from the sun may be considered as plane waves. For all practical purposes, a light wave-front originating, say, 100 feet distant may be considered as a plane wave-front. The waves from your screen to the projection lens are *diverging waves,* and from the lens to the screen are *converging waves;* but for practical purposes they may be considered as plane waves. You prob-



No. 6

ably won't believe this, but we'll prove it sometime.

Taking leave of plane waves for a while, let us consider diverging waves. You will note that the action in Fig. 6 is exactly the same. The belly flattens out, the front straightens out; then the ends get out first and the front begins to converge, but comes to a point much further out. These two points are called the *conjugate focii* of the lens; "jugate" means joined; "con" means together; the "conjugate focii" are the two points joined together or related in this particular lens, and a point light source placed at either place would be focused at the other. (Note that I said *point* source.)

If we move this point source closer to the lens (Fig. 7) the emerging front is curved less and less until when the light is at the real focus of the lens, the emerging wave-front is plane.

Spherical Aberration

When we move the point source in further to a point within the principal focus of the lens (Fig. 8) the wave-front does not get a chance to straighten out, the ends never do catch up, and it emerges as a diverging wave. This is all very simple—much too simple, in fact, for in practice nature hands out a lot of jokes and jolts to such things as preconceived notions and the like. We will spend a few minutes considering some of these "jokers."

First we shall consider *spherical aberration* (Fig. 9). The very thing that makes a lens change a wave-front (the varying thickness of glass) also causes the rays at different distances from the center of the lens to focus at different points—with the outer rays focusing closer, and the inner rays focusing farther away from the lens. This condition is corrected by various methods of grinding and by combinations of lenses.

We have an example of partial correction in Cinephor condensers, wherein one surface is parabolic and the other spherical. One point frequently overlooked is that even in the very best photographic lenses spherical aberration cannot be wholly corrected. The outer rays may be made to meet the inner rays, but the intermediate rays will not meet at the same point. The larger the diameter of the lens, of course, the greater the difficulty of correction. Hence, in a camera the smaller the diaphragm, the sharper the picture; in a projector, a diaphragm will sometimes improve an inferior projection lens, although it will cut down the light.

Another difficulty is *chromatic aberration* (Fig. 10). We said at the beginning that a pencil of light (represented by a line) was made up of millions of rays of light. If the light be white, it is made up of rays of many different wave-lengths—thousands of them, perhaps. Now, the effect of glass upon the speed of these rays is far different for each individual wave-length, so that if you had a lens corrected for spherical aberration, all the rays still would not come to a point: the blue would focus at, say, *b* and the red at *r*, and all the others in between.

Chromatic Aberration

Fortunately, chromatic aberration is comparatively easy to correct. Assuming that this lens is made of crown glass, a lens of flint glass of the same size and shape would spread the blues and reds much further, although the focal point in general would not be much different. A negative lens of crown glass would spread the light in the opposite direction, with the reds closest to the lens and the blues further away. And, a lens of flint glass would also spread them in the opposite direction, only still further apart.

So, to correct for chromatic aberration (Fig. 10A) we take advantage of these properties and combine a crown glass positive lens with a flint glass negative lens, which brings the blues and reds together but makes a combination of a little longer focus. Here again only two colors can be corrected for with two glasses; the others still are out, and it is customary to correct for the two brightest colors. Some high-grade photographic lenses have three glasses and correct for three colors.

Curvature of field must be corrected for (Fig. 11) to bring the outer edges of the picture in focus on a flat screen when the center is in focus. There are also the problems of astigmatism, coma, distortion and others which we shall not consider at this time.

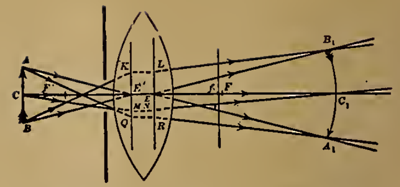
It is frequently asked from what point does one measure to get the focal length of a lens—from what part of a condenser lens and from where on the barrel of a projection lens. The answer is, generally: from somewhere inside the glass of a condenser and from somewhere between the two combinations in a projection lens.

When dealing with very thin lenses we may consider the lens as a line (like that in Fig. 12) and make our measurements from the center of the lens. While we are considering this drawing, I might describe briefly the point-to-point method of locating an image from an object. Just two simple rules are used, and while the problem can be very complicated, in this case the application is easy:

1. Horizontal rays always refract to the focus.
2. Central rays pass through without deviation.

The horizontal rays from the head of the arrow (Fig. 12) are refracted through the focus, and the central ray passes straight through the center; where the two meet is located the image of the starting point.

Here is a diagrammatic representation (Fig. 13) of a compound microscope which traces the paths through the objective lens and eye-piece lenses and shows the lenses as represented by straight lines, the particular shape of the glass making no difference. In fact, lenses are designed from such drawings, and when the separation and focal points are determined so as to get the results



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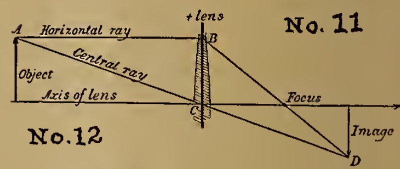

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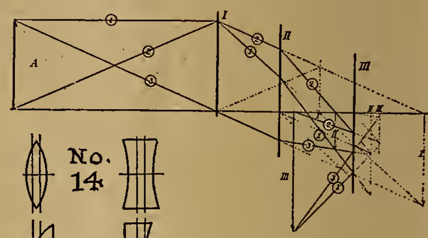

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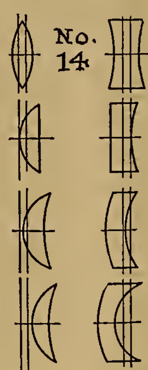

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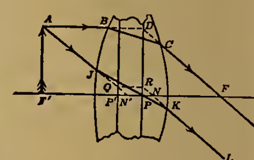

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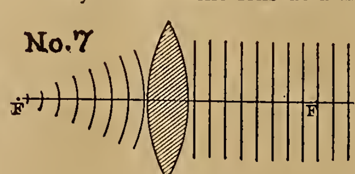

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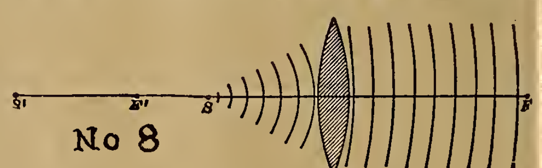

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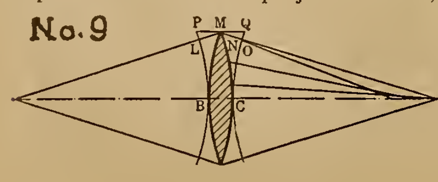

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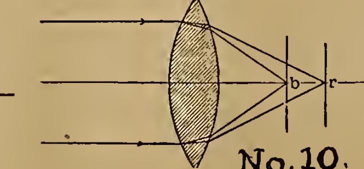

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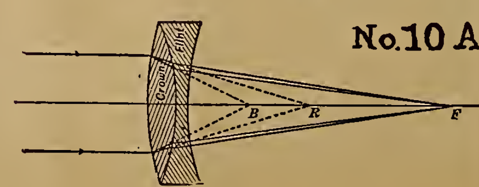

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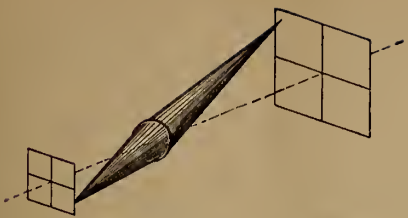


Figure 16

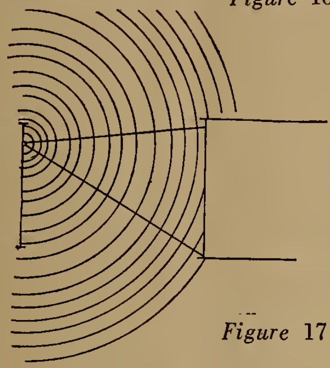


Figure 17

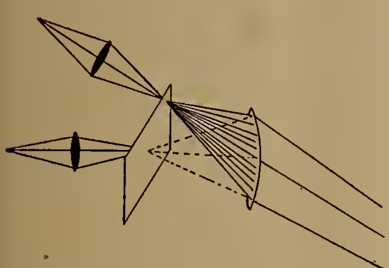


Figure 18

wanted, then the shape of the glass which will be necessary to give the focal points at the places indicated is determined.

But the lenses we use are not thin. They have considerable thickness, and before any calculations are made the nodal planes must be determined and measurements taken from them. Here are represented (Fig. 14) the approximate nodal planes of the common forms of lenses. You will note that these nodal planes are as if the line used to represent the lens in the previous drawing (see Fig. 11) were slit in two and pulled apart—which is just what you would suspect that thickness of glass might do.

Referring to Figure 15, follow the course of the ray through the lens and note how the drawing made to the nodal planes gives the same result as to the glass surface—so that for purposes of calculation the actual shape of the glass need not be shown.

Getting back to the question of from where are we to measure our lenses, the answer is:—in thick lenses we measure from the nodal planes; and if we keep these sketches in mind, we shall always have an approximate idea of the procedure. The actual point, of course, would have to be determined from each particular lens (see Fig. 14).

THUS far we have put forward but one principle of optics in addition to a few applications of that principle. In the preparation and presentation of this material it was my hope that I could stem the tide of wrong thinking in connection with lenses and their use and perhaps stimulate a new line of thought and re-direct this thought into the proper channels. It is bromidic to say that misinformation, even if sprinkled with grains of truth, is worse than no information at all, yet we see manifestations of the truth of this assertion in all sorts of printed works.

Once successful in directing our thoughts about lenses and light, and how they and it are used in our daily projection work, into the proper channels, it will be comparatively easy for the inquiring mind to track down much valuable information on the subject.

I am aware of the fact, of course, that many do not believe all I said in my last talk; and I am also aware that changes in habit of thinking about any subject must be brought about slowly. This is not strange, for after thinking of ink lines on paper as "rays" over a period of years, and after reading books and magazines which seemed to substantiate such opinion, it was too much to expect an instantaneous about-face.

To those who still think that I advanced a "new" theory, I can only repeat that the basic idea of my thesis on light was first promulgated in the 17th century and that this idea still is presented in unchanged form in various textbooks. It was from these latest scientific and technical publications that the accompanying figures were made.

The fact that light advances in wave-fronts, and varies in speed in different media, accounts for all the phenomena in which we as projectionists are interested. From this point on we shall deal only with practical application of light.

The Light Train

The light train from the arc to the screen may be divided into two classifications: (1) from the arc to the film, and (2) from the film to the screen. Endeavoring to attack this problem as *one continuous system* has been the undoing of many writers on the subject. I have tried many times during the past 15 years to make this point clear to inquirers and have not yet succeeded. I shall try again herein; and with the subject a bit more clear in my own mind, I may succeed; there is much merit in the view that a failure to clearly explain a point to another means that that point is not wholly clear in one's own mind.

I know that the idea that we must consider the light from the projection lens to the screen as diverging is quite general. Doesn't it so show up in this old stand-by (Fig. 1)? . . . diverging from the arc to the condenser; converging from the condenser to the projection lens; and diverging from the lens to the screen. Perhaps it has occurred to some to wonder why a bi-convex lens used in front of an arc is called a *condensing lens* because it converges the rays of the arc onto the film: and then that a bi-convex lens used as a stereoptican lens is said to *diverge*, or spread out, the rays all over the screen.

We must remember, however, that we are dealing with *wave-fronts* and not with *rays*. That form of light with which we are dealing is shown in Figure 6. An illuminated point on the film sends out spherical wave-fronts, diverging, a small portion of which are intercepted by the lens and changed to converging wave-fronts which come to a point on the screen.

Figure 16 represents the pattern from one point on the film. Now, in your mind, fill in the pattern from a million points in a frame of film and then tell me where the rays cross! Since rays are wave-front directions and since wave-fronts are crossing everywhere, the expression "crossing points of the rays" loses its significance.

Action of a Lens

Perhaps the custom of expressing the action of this fashion leads to the bad habit of thinking that the lens draws rays of light from the point in question. Of course, if we take the time to stop and think a bit we realize that the wave-front from the point really advances in all directions, as in Figure 17, and that the only purpose of drawing those boundary lines is to direct attention to the *only part* of the advancing wave-front that is acted upon by the lens.

I have considered the system in its simplest form from an illuminated point on the film to a similarly illuminated point on the screen. Now let us see how that particular point can best be illuminated, keeping in mind the fact that we are interested in illuminating a million separate points on that film and not the frame as a whole.

If we could develop some such method as is shown in Figure 18 by which each of the million points could be illuminated by a converging lens concentrating a minute brilliant point of light on it, we could get maximum brilliance; but we can't, so let us see what is the next best thing.

Consider first a central pencil of light (Fig. 19). We said that the ideal would be to concentrate the light on one point. Here we have it. The direct line on which this wave-front travels (shown by the middle line) does not change course. The front diverges from a brilliant grain of incandescent carbon in the crater to the condenser; then converges to a point on the film near the center; then diverges to the projection lens, and then converges to a point on the screen.

What happens when we get away from the central pencil? To get the proper viewpoint we must start at the screen and trace backward to find where the illumination needed must originate in order to give the necessary screen light.

The lines in Figure 20 represent the

(*Continued on page 47*)

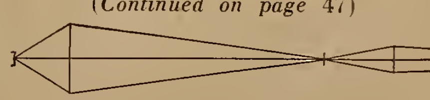


Figure 19

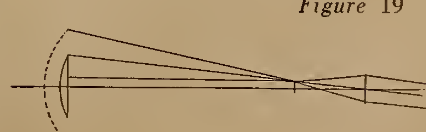


Figure 20

Table of Screen Image Sizes at Different Distances With Lenses of Varying Focal Lengths

Size of Picture Aperture: 0.825″ x 0.600″

E.F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.
2.00"	16.4 11.9	20.5 14.9	24.6 17.9	28.8 20.9	32.9 23.9	37.0 26.9	41.1 29.9	45.3 32.9									
2.25"	14.6 10.6	18.3 13.3	22.0 16.0	25.6 18.6	29.2 21.2	32.9 23.9	36.6 26.6	40.2 29.2	43.9 31.9	47.5 34.6							
2.50"	13.1 9.6	16.4 11.9	19.7 14.4	23.0 16.8	26.3 19.1	29.6 21.5	32.9 23.9	36.2 26.3	39.5 28.7	42.8 31.1	45.6 33.5						
2.75"	12.0 8.7	15.0 10.9	17.9 13.0	20.9 15.2	23.9 17.4	26.9 19.6	29.9 21.8	32.9 23.9	36.0 26.1	39.0 28.3	42.0 30.5	45.0 32.7	48.1 34.9				
3.00"	10.9 8.0	13.7 10.0	16.4 11.9	19.2 14.0	22.0 16.0	24.6 17.9	27.4 20.0	30.2 22.0	32.9 23.9	35.7 25.9	38.4 27.9	41.1 29.9	43.9 31.9	46.7 34.0			
3.25"	10.1 7.3	12.7 9.2	15.2 11.0	17.7 12.8	20.2 14.7	22.8 16.6	25.3 18.4	27.8 20.3	30.4 22.1	32.9 23.9	35.5 25.8	38.0 27.6	40.5 29.5	43.0 31.3	45.6 33.1		
3.50"	9.4 6.8	11.7 8.5	14.1 10.3	16.4 11.9	18.8 13.7	21.1 15.4	23.5 17.1	25.9 18.8	28.3 20.5	30.5 22.2	32.9 23.9	35.2 25.5	37.5 27.3	39.9 29.0	42.3 30.8	44.7 32.5	47.0 34.2
3.75"		10.9 7.9	13.1 9.6	15.3 11.1	17.5 12.8	19.7 14.4	22.0 16.0	24.0 17.6	26.3 19.1	28.6 20.7	30.7 22.3	32.9 23.9	35.2 25.6	37.3 27.2	39.5 28.8	41.7 30.3	43.9 31.9
4.00"		10.2 7.4	12.3 8.9	14.3 10.4	16.4 11.9	18.5 13.4	20.5 14.9	22.6 16.4	24.6 17.9	26.7 19.4	28.8 20.9	30.8 22.4	32.9 23.9	35.0 25.4	37.0 26.9	39.1 28.4	41.1 29.9
4.25"		9.7 7.1	11.7 8.5	13.5 9.8	15.5 11.2	17.4 12.7	19.3 14.0	21.2 15.4	23.2 16.8	25.2 18.3	27.1 19.7	29.1 21.1	30.9 22.5	32.9 23.9	34.9 25.3	36.8 26.8	38.8 28.2
4.50"			10.9 8.0	12.8 9.3	14.6 10.6	16.4 11.9	18.3 13.3	20.1 14.6	22.0 16.0	23.7 17.2	25.6 18.6	27.4 20.0	29.2 21.2	31.0 22.6	32.9 23.9	34.8 25.3	36.6 26.6
4.75"			10.4 7.6	12.2 8.9	13.9 10.1	15.7 11.4	17.3 12.6	19.0 13.0	20.7 15.1	22.5 16.4	24.2 17.6	26.0 18.9	27.6 20.1	29.4 21.4	31.1 22.6	32.9 23.9	34.7 25.2
5.00"				11.6 8.4	13.1 9.6	14.9 10.8	16.4 11.9	18.1 13.2	19.7 14.4	21.4 15.6	23.0 16.8	24.6 17.9	26.3 19.1	27.9 20.3	29.6 21.5	31.3 22.8	32.9 23.9
5.25"				10.9 7.9	12.5 9.1	14.1 10.3	15.7 11.4	17.2 12.5	18.8 13.7	20.3 14.8	21.8 15.9	23.5 17.1	25.1 18.3	26.7 19.4	28.3 20.5	29.8 21.7	31.3 22.8
5.50"				10.5 7.6	12.0 8.7	13.5 9.8	15.0 10.9	16.4 11.9	17.9 13.0	19.4 14.1	20.9 15.2	22.4 16.3	23.9 17.4	25.4 18.5	26.9 19.6	28.4 20.6	29.9 21.8
5.75"					11.3 8.3	12.8 9.3	14.2 10.3	15.7 11.4	17.1 12.4	18.6 13.5	20.0 14.5	21.4 15.6	22.9 16.6	24.3 17.7	25.8 18.7	27.2 19.8	28.6 20.8
6.00"					10.9 8.0	12.3 8.9	13.7 10.0	15.1 10.9	16.4 11.9	17.8 13.0	19.2 14.0	20.5 14.9	22.0 16.0	23.3 17.0	24.6 17.9	26.0 18.9	27.4 20.0
6.25"					10.5 7.7	11.9 8.6	13.1 9.5	14.3 10.4	15.9 11.4	17.0 12.4	18.4 13.3	19.7 14.3	21.0 15.3	22.3 16.2	23.6 17.2	25.0 18.1	26.3 19.1
6.50"						11.4 8.3	12.7 9.2	13.9 10.1	15.2 11.0	16.4 11.9	17.7 12.8	18.9 13.7	20.2 14.7	21.5 15.6	22.8 16.6	24.0 17.5	25.3 18.4
6.75"						10.9 7.9	12.2 8.8	13.4 9.8	14.6 10.6	15.9 11.6	17.0 12.4	18.3 13.3	19.5 14.2	20.7 15.1	22.0 16.0	23.2 16.9	24.4 17.8
7.00"						10.5 7.6	11.7 8.5	12.9 9.4	14.1 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.8 13.7	19.9 14.5	21.1 15.4	22.3 16.2	23.5 17.1
7.50"							10.9 7.9	12.0 8.7	13.1 9.6	14.2 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.7 13.6	19.7 14.4	20.8 15.2	22.0 16.0
8.00"							10.2 7.4	11.2 8.2	12.3 8.9	13.3 9.7	14.3 10.4	15.4 11.2	16.4 11.9	17.4 12.7	18.5 13.4	19.5 14.2	20.5 14.9
8.50"								10.6 7.6	11.7 8.5	12.6 9.1	13.5 9.8	14.5 10.5	15.5 11.2	16.4 11.9	17.4 12.7	18.4 13.4	19.3 14.0
9.00"									11.0 8.0	11.8 8.6	12.8 9.3	13.7 10.0	14.6 10.6	15.5 11.3	16.4 11.9	17.3 12.6	18.3 13.3
E.F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.

SIZES GIVEN ARE TO THE NEAREST TENTH OF A FOOT

Prepared especially for INTERNATIONAL PROJECTIONIST by Bausch & Lomb Optical Co.

FILM STOCK: TYPES AND USES

THE competent physician is familiar with the surgeon's instruments, even though he himself does no surgery. The projectionist deals only in finished film, but the thorough-going practitioner in projection may welcome an opportunity to clinch his knowledge of the tools used by the surgeons of the motion picture industry — those who, dealing indirectly with the public *through projection*, specialize in the operations that make pictures.

Films of various types are the pliable tools of Hollywood and New York and Chicago. To satisfy projectionists' desires for fuller information about film, a glossary of the types, present and recent, is here offered.

Orthochromatic Negative. Until the introduction of panchromatic motion picture film, orthochromatic negative was in universal use for outdoor work and studio work. "Color blind" film is sensitive only to the blue, the violet, and the ultra-violet rays reflected from any photographic subject. Orthochromatic, in addition, is sensitive to the yellow-green, but not the red . . . Orthochromatic has been almost entirely superseded by panchromatic types of film.

Panchromatic Stocks

Panchromatic Negative. Panchromatic film is sensitive to the red, as well as to the colors which affect orthocromatic film. Improved photographic rendition of tone values results from sensitivity of film to the whole visible spectrum. Upon its introduction, panchromatic negative was used principally for outdoor work.

Panchromatic Negative, Type 2. Introduction of this film followed that of the original panchromatic. Greater speed made Type 2 "Pan" useful for studio work as well as out-of-doors, and it quickly came into the most general use. Increased speed, in photographic terminology, means simply the ability to record an image with less light.

Super-Sensitive Panchromatic, Type 2. Introduced not quite two years ago, this type of negative has in turn largely superseded previous types of negative material. About three times as fast as Type 2 "Pan" under artificial light, Super-Sensitive gives equal studio results with very much less light, thus reducing heat, glare, and cost in production. Greatly increased sensitivity to red light is responsible for the trebling of this film's speed under artificial light.

Artificial light contains a higher proportion of red than does sunlight. But since Super-Sensitive "Pan" is also faster out-of-doors, it is the most widely used all-purpose negative. In addition to the reduction of necessary lighting, the greater speed of this film makes greater "depth of focus" possible, which means that actors can be moved about more freely without getting out of focus. Despite its great speed, Super-Sensitive "Pan" is even finer-grained than previous types.

Super-Sensitive Panchromatic (Gray Backed). With the same emulsion qualities as the original Super-Sensitive "Pan," the gray-backed type of film is not subject to halation around bright lights or brilliant spots in the picture field.

Positive. Theatre prints are made on positive film with a nitrate base. Since speed is not an important factor in makink prints, positive film is much slower than negative, with an emulsion composed of very fine silver-salt grains.

The Sonochrome Series

Tinted Positive. Before sound, tints were widely used for theatre prints. With the advent of sound, the existing tinted positive became useless, because certain tints in the base interfered with the passage of the light through the sound track to the photo-electric cell. Eastman Kodak Company overcame that obstacle by producing a series of seventeen "Sonochrome" tints which had a minimum of obstructing effect on the useful light passing through the sound track.

The purpose of the Sonochrome series of tinted films is to enhance, by inducing moods which are subconsciously associated with colors, the emotional significance of various scenes. Although gray, as projected by untinted film, may deepen certain moods of the screen, the peaks of emotion are usually flattened off by gray; whereas psychological tests have well established that colors do have certain consistent emotional effects.

Positive (Acetate Base). The so-called safety film is used for non-theatrical prints where no projection room is available.

Duplicating Positive. To guard against loss, as well as to speed up the making of prints, it is common studio practice to make duplicate negatives from finished original negatives. Of course it is necessary that a duplicate negative shall give a print which is a facsimile of a print from the original negative. To that end, special film is necessary both for the duplicate negatives and for the master positive, which is the intermediate material used in making duplicate negatives.

Duplicating positive film has a lavender base, which serves to reduce halation effects in printing and also serves for identification. The emulsion is capable of giving very fine-grained images with good contrast on full development. The "latitude" of the emulsion is such as to insure correct reproduction for the greatest range of tones likely to be met in an original negative.

Duplicating Negative. With sufficient printer speed so that enough exposure can be obtained through the dense master positive without changing printer lamps, duplicating negative film possesses, in common with duplicating positive, the qualities of latitude, fine-grained image with good contrast, and reduction of halation. In the case of duplicating negative, a yellow dye in the emulsion accomplishes the reduction of halation.

Two-Color Prints

Duplicate Positive. Coated with an emulsion on each side, this film is used for two-color prints. After a negative or two negatives, according to the process, have recorded two sets of black-and-white images taken through light filters of complementary color—usually orange and green, respectively—a printing device registers the two sets of images on opposite sides of the duplitized positive film. The two sides are then dyed in complementary colors *exactly opposite* from those of the camera filters—in other words, green and orange, respectively.

White light from the projector, passing through the two-color film, then throws upon the screen—a picture that has the appearance of natural color.

From I.P., September, 1932

GUARD YOUR EYES

Don't

read with the light shining into your eyes.

read when recovering from serious illness—without your doctor's consent.

read when lying down unless your head and shoulders are propped up and the page is held at right angles to your line of vision.

use public towels. Be careful about rubbing eyes with fingers, dangerous infection may follow.

hold your work or book nearer the eyes than 12 inches.

fail to visit an eyesight specialist at the *slightest sign* of eye trouble.

use eye-washes, ointments, salves or other remedies unless advised by an eyesight specialist.

wear glasses not prescribed by an eyesight specialist.

★From I.P., August, 1932

DISTORTION (PROJECTION AND VIEWING) IN MOTION PICTURES

★ By CLIFTON TUTTLE

THE whole subject of warped perspective and distortion can conveniently be divided into three phases in accordance with three causes which adversely affect true rendition of form on the screen and in the eye of the observer. These are: (1) The discrepancy between camera point of view and audience point of view involving the relative values of camera and projector lens focal lengths. (2) The vertical elongation of figures and the keystone effect resulting from projection from a point above the screen. (3) The error in perspective caused by the off-center view seen by many members of the audience.

The three types of distortion are, of course, additive in their effects, but for the sake of simplicity in this discussion it seems best to treat them singly.

Projection at an angle and viewing at an angle are causes of distortion which can not be eliminated in practical presentation; but since both these are controllable to some extent in the design of theatres, it remains of practical interest to consider these matters and perhaps to specify limiting values for the guidance of architects and theatre owners.

The question of projection angle has been frequently discussed before the S. M. P. E., the most thorough treatment of the problem being that presented by the Projection Committee in 1929. The Committee recommended, first, that the angle be kept as near zero as possible, and then proceeded to analyze the amount of distortion as a function of the angle of divergence of the projected beam and of the angle which the axis of projection makes with the horizontal. They expressed the distortion as the percentage increase in height which results when the picture is projected at an angle to a vertical screen.

To quote from this report: "Now, the maximum permissible amount of distortion is a matter on which there seems to be considerable divergence of opinion. The Committee feels that in recommending 5 per cent as the maximum increase in picture height, it is erring on the side of laxity rather than on that of rigidity." For practical projection conditions a projection angle of 17 degrees results in an increase of image height of about 5 per cent. The Committee therefore fixed on this angle as the limiting value.

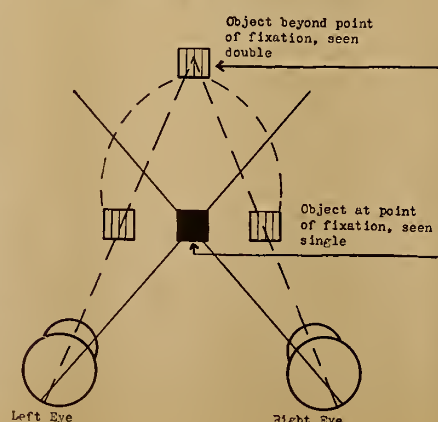
The author has been supplied with data concerning the projection angles existing in one chain of theatres. These data show that about 60 per cent of the theatres in this group have projection angles equal to or greater than that recommended by the Committee, and about 80 per cent have an angle greater than the more rigorous specification of 12 degrees recommended in the standards adopted by the Society as the limiting value. Since the theatres of large seating capacity have the larger projection angles, it follows that the vast majority of theatre patrons habitually see pictures which are projected at angles greater than 12 degrees. It would seem desirable either to bring the recommendation of the Society into line with practice or to exert pressure to bring future practice into line with our recommendation.

It seems indeed that the 5 per cent increase in the ratio of height to width is a lax enough tolerance. Consider for a moment the effect on the human figure. The 17-degree projection angle should in its effect be roughly equivalent to the once highly advertised 18-day grapefruit diet. Greta Garbo, Ruby Keeler, Joan Crawford and others in the lightweight class apparently lose five or six pounds by the treatment.

There is a strong tendency on the part of the general public to accept what it sees on the motion picture screen as the last word in fashion and beauty. Large projection angles may, therefore, be largely responsible for the vogue for slender figures.

There is, of course, a second defect in an image projected at an angle which follows from the fact that the bottom of the screen image is magnified more than the top. What should be vertical lines in the image become convergent upward. A rectangular screen shape is maintained by shaping the mask, but nothing is done to rectify the convergence of lines within the picture. It is well known that the eye is extremely sensitive to the lack of parallelism between two lines. Mitchell[1] has recently thoroughly discussed this question for the edification of the cameraman, pointing out several matters which should be observed in scene composition. In some actual cases in theatre projection the convergence amounts to five or six degrees, which is very apparent at the edge of the screen.

Illustrating binocular vision



Fortunately, the attention of the audience is seldom concentrated on vertical lines in a picture. This is more true now than in the days of silent pictures with its numerous titles. It seems, therefore, that experimental demonstration of the practical effect of projection angle should be confined principally to such subjects as make up the greater bulk of motion picture presentation.

In view of the data which show that many successful theatres have projection angles in excess of the arbitrary limit recommended by the Society, it seems of interest to proceed to experiment on the basis of determining the degree of distortion at which the illusion of naturalness breaks down.

A number of still pictures of motion picture scenes were reproduced as lantern slides. These were projected on a screen at vertical angles which gave progressively 2.5, 5, 10, 15, and 20 per cent distortion. The screen picture was photographed at each position and lantern slides were made of the results.

All the groups of slides thus obtained were thoroughly shuffled together so that during projection no one of a series of slides would follow another of the same subject. The slides were then shown to a group of persons, each of whom was asked to select all pictures which looked unnatural and to state the reason for the objection.

Results of this test are summarized in Table I. In column one of this table, the subjects have been classified in a general way. The terms "close-up," "semi-close-ups," and full-length figures" apply to human figures. Well-known inanimate subjects included pictures of houses, doorways, wagons (showing wheels) etc. The remaining columns headed by the value of distortion in per cent contain the record of the relative number of observers who objected. In-

From I.P., October, 1933

[1]Mitchell, R. F.: "Projection Keystoning from the Cameraman's Viewpoint," **Amer. Cinematographer**, XIII (Jan., 1933), No. 9, p. 8.

dividuals participating in the test were not informed of its object, and they probably were neither less nor more critical than members of the usual motion picture audience.

The conclusion from these data is that for scenes in which actors or actresses form the principal interest, the image can be distorted 10 per cent before the illusion of naturalness is impaired. Stated in another way, this means that most persons unacquainted with what the real subject looks like are satisfied even though the picture is decidedly distorted. In the case of very familiar objects of definite shape as, for instance, a picture in which there was an axial view of a wagon wheel, the tolerance is somewhat narrower—some persons objecting when the image is distorted as much as 10 per cent.

Definition and Area Losses

This discussion thus far has been limited to true image distortion. There are two other undesirable effects, however, which accompany projection at an angle. The first is the loss of image area which follows inevitably when the sides of the picture aperture are cut to make the frame rectangular. The second is the effect upon top and bottom image definition because of the path difference.

Though neither of these can properly be classified as distortion, an evaluation of both has been included in Table II. The third column shows approximately the area loss in per cent which results when a picture is projected with a 6-inch lens to a rectangular vertical screen, and the fourth column shows the diameter of the circle of confusion, or, more accurately, the major axis of the ellipse of confusion at the bottom and top of the field for a perfect lens working at an aperture of $f/2$.

The area loss, that is, the amount which must be masked from the lower corners of the picture, is not particularly serious at any commonly used combination of projection distance and focal length—provided that the elongated picture is not masked off to maintain the 3 x 4 picture.

The lack of definition as judged from a viewing distance of twenty feet becomes noticeable if the image size exceeds about 1.5 mm. Since the image size resulting from the projection angle is superposed upon the effect of the lens aberrations, it is probably reasonable to state that with practical projection lenses of $f/2$ aperture, definition suffers noticeably at projection angles greater than 17 degrees.

The second matter upon which some experimental data may prove of advantage concerns the viewing angle forced upon all the members of an audience except those located opposite the screen center. At first thought, this problem appears to be closely related to the former one. Both projection at an angle from the horizontal and viewing at an angle other than the normal, produce a similar kind of elongation of the screen image, and one might expect that a distortion tolerance set up for the one case might apply to the other. The conditions, however, are somewhat different: a person viewing the screen from an angle is conscious of his point of view, and instinctively makes a correction for some distortion of the image. He is not conscious of the projection angle, and therefore has no means of compensation which will aid him in rectifying his concept of the picture.

It is common experience that motion pictures viewed from extreme front and side seats in some theatres appear badly distorted. At the same time, it is true that one's enjoyment is not adversely affected until the angle becomes fairly large. The author has attempted to determine the limiting angle experimentally by projecting before a group of persons motion pictures of a screen image photographed at different angles. There seems to be quite good agreement among the persons before whom these and other pictures of the same kind were shown that any angle less than 30 degrees is not objectionable. Forty degrees seems to be passable, but the opinion was unanimous that the illusion is spoiled at angles greater than 40 degrees.

One can not say that these demonstrations adhere closely enough to theatre conditions to justify any general conclusions. One is quite justified in asking: How much does motion in the picture affect the feeling that the illusion has failed? And how much does the angular field of view change one's judgment?

A few trials were made in which a large black border was shown around the rotated picture. This, is was thought, would supply a comparison reference as to the amount of foreshortening to be expected in the picture. The judgment of distortion did not seem to be much changed. Pictures filling the screen appear better to represent the view which a member of the audience has in a seat close to the screen—the only location in which the viewing angle problem is serious. On the basis of a number of observations in theatres during the projection of pictures, it appears that motion in the picture does not affect the result to any great extent.

A seat which forces one to see any part of the picture at an angle greater than 40 degrees is undesirable. For full-length figures the judgment is more critical.

The larger the screen, of course, the worse is the distortion at the farthest edge at a given viewing distance. In recommending practice for the guidance of designers and architects, the specification for the position of the extreme seat should be based upon the angle at which this edge can be seen. Assuming that the distance from the first row of seats to the screen is equal to 1.5 times the screen width, the first row of seats should be not longer than 1.5 times the screen width if the extreme viewing angle for the edge is not to exceed 40 degrees. Data supplied to the author give the average maximum viewing angle of a number of theatres at 34 degrees at the screen center—an angle which makes the edge viewing angle somewhat in excess of the distortion limit.

Distortion Remedies

Many attempts have been made in the past to cure the evil of viewing angle distortion—usually by the use of curved screens. Anamorphotic lens systems also have been suggested. The fallacy of such suggestions has been pointed out so frequently that apparently no proposal of this kind has been made for several years. There is, of course, no remedy except proper design of the seating space. Any correction of the screen image for one position can be made only at the expense of the perspective from other positions.

Correction of projection angle distortion is not so impossible theoretically. Partial compensation can be effected by tilting the screen. This means probably presents some mechanical difficulties, since it is not commonly used. Other partial remedies are at least theoretically possible.

Putting the results of the experimental data in the classic form attributed to Barnum, most of the people most of the time are totally fooled up to a projection angle distortion of 10 per cent. All of the people all of the time are dissatisfied with a seat which forces them to see part of the screen at an angle greater than 40 degrees.

TABLE I

Summary of Data Showing Susceptibility of an Average Audience to Different Degrees of Distortion

Subject	Relative number of observers who objected in per cent of total number of observers					
	Per Cent Distortion					
	0	2 5	5	10	15	20
Close-ups	0	0	0	0	0	20%
Semi-close-ups	0	0	0	0	5%	25%
Full-length figures	0	0	0	0	15%	50%
Well-known inanimate subjects	0	0	0	10%	40%	50%

TABLE II

Effect of Projection Angle upon Screen Definition and Loss of Area with Rectangular Masking

Projection Angle (degrees)	Per Cent Distortion	Area Loss, Per Cent	Image Size Bottom and Top of Screen, Mm
0	0	0	–
12.5	2.5	2	0 9
17 5	5 0	3	1 3
21.5	7.5	4	1 7
24 5	10.0	5	2.0
27.0	12.5	5	2 2
29 5	15 0	6	2.6

★ *Maintaining Motor Generators* ★

By A. C. SCHROEDER

THE first consideration in the maintenance of motor generator sets is lubrication. There must always be plenty of clean oil. Only mineral oil is used in these machines; animal or vegetable oils are not satisfactory. Everyone knows what the lack of oil will do: overheated bearings, premature wear, scored journals, ruined bearings. Dirt in the oil has much the same effect. Dirt is a cutting agent, embedding itself in the softer metal and then scratching the other surface against which it rubs.

Oil that is too heavy will not allow the oil rings to rotate when the temperature is very low, thus "starving" the bearings. A light oil is the proper one to use, so that it flows freely even in the coldest weather. Keep the oil even with the top of the cups that are on the sides for checking the level. Notice if the rings are revolving, and whether ample oil is being carried up by them.

Oil should be changed about every six months. If it comes out black and dirty, fill the bearings with clean oil and then drain it out again after running the machine a little. Do this until the oil comes out clean.

In the case of overheated bearings on one of the smaller machines, slow it down if possible, but do not let it stop, as it is likely to stick. On a large machine it is safer to keep it running than to take a chance of it "freezing up." Flood the hot bearing with clean oil. Do not use water under any circumstances. It takes time to cool a bearing, as there is a large amount of metal that is overheated.

When a bearing overheats, something is radically wrong. In a new machine this condition is not surprising, but when it occurs after a machine has been running well for some time, it is usually due to neglect or carelessness. Some causes of overheating are: a scored shaft, bent shaft, bearings too tight, bearings improperly fitted, although not tight; bearings out of line, oil ring stuck or broken, lack of oil, dirty oil, diluted oil (water, coal oil or some other substance in the oil) and overloaded bearings. An overloaded bearing is a rare occurrence, except in a belt-driven machine where the belt is too tight. Bearings out of line really cause an overloaded condition, but this is not thought of in that way.

Mica will project after the copper wears a little

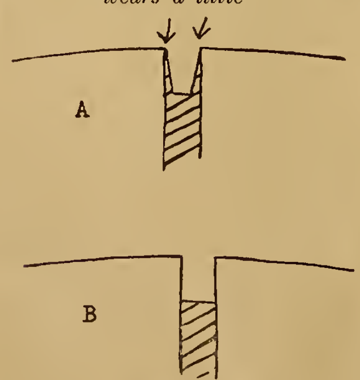


Figure 1

Figure 2

The remedy for any of these conditions is obvious. When a shaft has been scored, it is important that it be put in condition before being used again.

A commutator that is in good condition will be dark, very smooth and shiny. By dark I do not mean black. A black commutator will not be smooth nor will it shine; something is wrong. When it appears as at first mentioned it is easy to take care of. Never touch it with sandpaper. A lubricant must be applied *sparingly* and not too often. There is much discussion as to what is the best lubricant. I have used both vaseline and oil, but I cannot see any great difference, although I favor oil. A small amount is put on a cloth and applied to the commutator while the machine is running. Spread the lubricant over the entire surface. This will be enough to lubricate, yet there will not be enough to cause trouble.

A burned, dirty, or rough commutator should be sanded, unless it is out of round, in which event it must be turned down. Use fine sandpaper, and (we repeat what has been said hundreds of times before) *never use emery cloth.* Sanding is usually not the only thing to be done in this case; the cause of the trouble must be found. The possible causes are numerous: brush tension too heavy or too light, brushes sticking, improper brush contact, some of the brushes disconnected or not touching the commutator on machines having two or more brushes in parallel, thus overloading the remaining brushes; out of round commutator, high or low bar in commutator, high mica, grounded or shorted commutator bars, open or short-circuits in armature, and a grounded armature.

Loose bearings may cause commutator trouble, as will an overloaded machine. Some of the aforementioned troubles may cause the solder to fly out of the commutator.

Not all of these troubles can be repaired by the projectionist. Brushes can be fitted and adjusted, also freed up in the holders; brush tension can be adjusted; "shorts" in the commutator can be found, such as metal particles lodged between the bars; sometimes "shorts" and open circuits can even be located and repaired in the armature, but usually these will have to be sent out. When the commutator is out of round, or a segment is high or low, it must be sent out to be repaired.

Ridges and uneven wear can be corrected by the use of special stones. They are mounted in holders with a handle on them and are applied to the commutator while the machine is running. Stoning is continued until all ridges and uneven surfaces have been removed. The commutator can be put in good condition this way, if it is not out of round.

The mica must be inspected after stoning the commutator. It must be well below the surface of the copper bars. It will probably be necessary to undercut the mica, which is done with a tool similar to that shown in Figure 1. A piece of hacksaw blade is used, one end being wrapped with tape, so it can be held without injuring the hand. It often is necessary to grind the sides of the teeth so they just fit the space between segments of the commutator. The tool is moved back and forth on top of the mica, keeping the blade between the segments. Work carefully, as the blade has a habit of leaving the groove and cutting a deep scratch across the commutator face.

Figure 2 shows the right and the wrong way of doing this job. The cut shows two commutator bars and the space between them. At *A* is an improperly undercut mica, shown by the shaded portion. At *B* the mica has been cut down clean on both sides of the groove and the top of the mica is well below the surface of the copper. When a commutator is undercut as at *A*, it requires only a little wear of the copper before the mica at the two corners of the segments will be flush with the copper. The mica does not wear as rapidly as the copper and from then on it will protrude further and further, partially holding the brushes away from the commutator, thus causing sparking and more rapid wear and burning of the copper bars.

After undercutting, sand the commutator with fine paper, blow away the dust with bellows and oil the surface lightly.

When commutator and brushes are in

(*Continued on page* 23)

From I. P., Jan. and Feb., 1933

We keep *Projectionists* in mind

Many projectionists have expressed a preference for RCA Photophone equipment. They like its compactness, because there are no extra parts sticking out from the sides to make it difficult to walk and work between the machines. They like the ease of operation. They like the sturdiness and reliability of performance. And they like especially the simplicity and accessibility, which mean the work of the projectionist can be done skilfully and perfectly.

These attractive features were not mere accidents. They were deliberately built into the equipment, with the needs of projectionists in mind. The only way to build a successful business is to satisfy customers and users. That we have the interests of the projectionist at heart is shown by the manner in which RCA Photophone apparatus enables him to maintain and enhance his reputation for skill in his profession.

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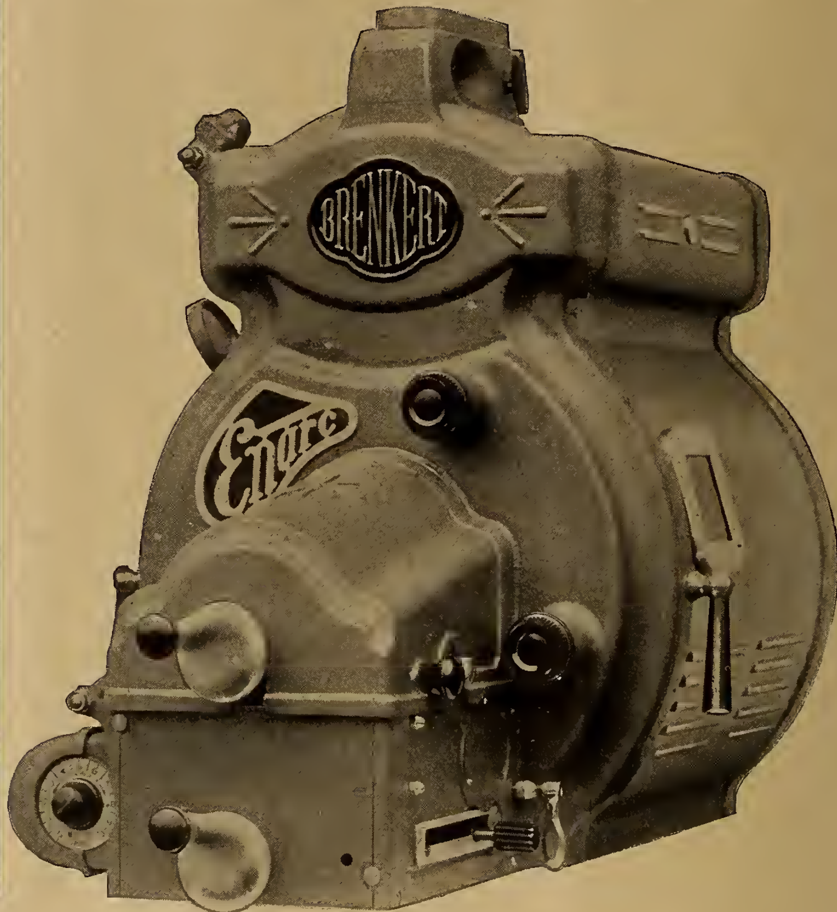

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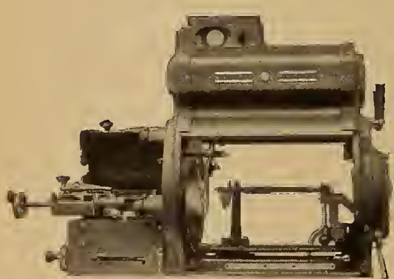

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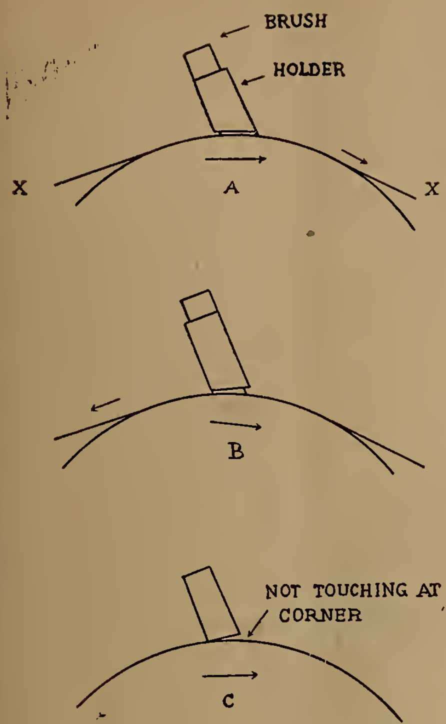

Figure 3

good condition, they do not require much attention. The brushes should be worked up and down in their holders occasionally to see if they are free and are not sticking. At the same time notice the tension. As the brushes wear, the tension becomes less. The tension cannot be judged if the brush is sticking, thus the first thing is to free the brush. If doubtful as to whether the brush is free, remove the spring while the brush is worked up and down in the holder.

Sticking is nearly always due to a gummy deposit on the brush or in the holder. After cleaning the brushes and the holders, the brushes should be put back in their respective holders, because it is almost impossible to have all the holders adjusted exactly alike. When the brush is put back so that it strikes the commutator at a new angle, it will not fit properly.

The tension can now be adjusted. Too much tension is undesirable because of excess wear, also because the commutator runs at a higher temperature due to increased friction. Not enough tension causes the brush to vibrate, and the contact between it and the commutator will be poor, causing sparking and also heating and wear of the copper.

Probably the best indication of the brush tension is sparking or absence of sparking. There are, of course, other things that cause sparking; nearly all armature troubles show up in this way, as does overloading of the machine. When the machine is running perfectly and is delivering a normal load, there should be only the very faintest trace of a spark at the brushes. It usually is visible only when getting in a position so that one can look almost right between the brush and the commutator. The sparks will be very small and extend clear across the width of the brush, and all the brushes will have the same amount of sparking. When pressing the brush against the commutator lightly results in considerable decrease in sparking, the tension should be increased. If this does not cause much change, the tension is probably sufficient. Try decreasing the tension a bit, and if this results in increased sparking the tension has been too light. The idea is to get just enough tension to reduce sparking to a minimum and then increase it a trifle in the interest of safety.

PROPER fitting requires that the brush be lifted and sandpaper placed between it and the commutator, with the back of the paper next to the commutator. The brush then is dropped, and the paper is drawn past it in the direction that the commutator turns. This latter instruction is extremely important because if the paper be drawn through in the opposite direction, the brush will be improperly fitted. This is repeated until the brush is fitted.

At A in Figure 3 is shown the correct way to accomplish this. There is a slight amount of play between the brush and its holder, which is necessary so that it will not stick. The arrow within the curved line shows the direction of rotation of the armature, the curved line representing the commutator. The brush touches the lower part of the holder at the right, while at the upper end it touches the holder at the left. XX represents the strip of sandpaper.

When the sandpaper is drawn in the direction shown by the arrow above it, the brush is pulled into the same position as it occupies during normal operation of the machine, and this fit will be right. If the paper be drawn the other way, as shown at B, the brush is tipped the opposite way in the holder, consequently changing the angle it makes with the commutator. If the brush would stay in this position when in normal operation, everything would be in order; but when the machine starts, the brush assumes the position as at A (Fig. 3) with the result that the face of the brush does not fit the commutator. This is shown at C. Not only will this cause overloading of the brush, as a small area has to carry the current that the entire brush is supposed to carry, but also sparking and improper commutation.

It is important that the sandpaper be

(*Continued on page* 43)

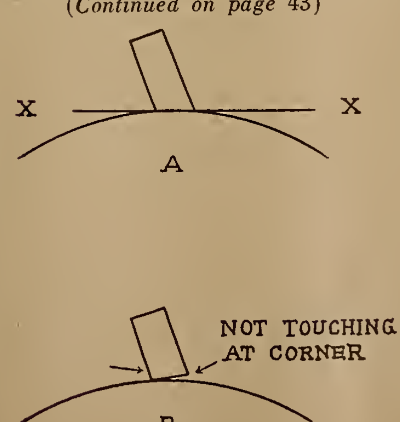

Figure 4

Show Business

By WALLACE G. CROWLEY

DINNER on a tray in my room and not alone—that's luxury in some countries, but not to me on matinee days . . . it's actual necessity . . . the room I referred to is the projection room . . . the company, another projectionist . . . did you ever try making a change-over while balancing a piece of pie in one hand? . . . A real projectionist is one who in an emergency will sacrifice the pie . . . That's a tough yardstick to measure up with . . . Saturdays and Sundays are our week-days wherein we work longer hours.

It's great getting to watch the happy crowd making their ways to seats during a Sunday night intermission . . . You sort of realize that we are not one of the happy majority . . . We lead a life far apart from that of the butcher, plumber, clerk, or business man . . . While they play we work . . . Their amusement is our toil . . .Their idly-dropped fifty-cent piece is the source of our very existence . . . Ever count two rows of heads in a balcony and remark that there sits my week's pay?

Have you ever regretted the necessity for being away from home Sundays, holidays and evenings? . . . No idle chatting over the back fence with your neighbor on Saturday afternoon . . . No Sunday stroll through the park with the wife and kids, watching the array of happy humanity on parade . . . When the Thanksgiving turkey is only half eaten, you apologize hastily to the guests and hurry away . . . While the kids are happy with their new toys playing around the Christmas tree . . . One of them pauses and shouts, "Ma; where's Daddy?" The answer comes with just a touch of sadness in the tone, "He's gone to work at the show, dear" . . . If all this could apply to you—and you have no regrets or self-reproach, then you'll be a real success in this show business . . . *you heartless wooden Indian.*

Sitting at the bedside of a dying projectionist who said that he was glad he had been able to bring happiness to so many people . . . in the strained mock hospital gaiety the remark went unnoticed . . . days later, after it was all over, it dawned on me what he really meant . . . he couldn't have lived in vain; his daily work was to cause lights and shadows to lull thousands of restless world-weary minds into forgetfulness—oblivion for a time—gained by staring at his handiwork on the screen. They *lived* for a time with kings and queens—returned to reality only when the curtain closed and the lights came up. They go their various ways better beings because of their brief respite from reality.

★From I. P., Dec., 1931

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GEORGE E. BROWNE, *President*

DO THESE STATEMENTS CONFUSE YOU?

★

"Electron flow and current flow are the same; therefore, current flows from negative to positive." ★ *"The direction of current and the direction of electrons are opposite."* ★ *"The movement of the electrons through the circuit is current flow. The direction of the electron flow is from negative to positive . . . The directon of current from a D.C. generator is from the positive brush through the external circuit to the negative brush . . . When the direction of the current is known, the direction of the resulting flux may be determined by the right-hand rule."* ★ *"Although we speak of the current as flowing from positive to negative of the circuit, the electrons (which really are the current) flow from negative to positive."*

Relation of Electron Flow to Current Flow

By N. H. RANDALL

THE substance of each of the accompanying introductory statements was taken from as many text and reference books on radio theory. To the technically trained they are understood and accepted from the viewpoint adopted by the author of the book; but to the person just starting out to master the principles of electricity and radio, and studying from the numerous references at hand, this apparent contradiction is often confusing. Of course, there is always an explanation added stating that the mix-up is due to the fact that the direction of current was assumed to be from positive to negative before the action of electrons was known.

But does this statement clear up the matter to the new student? Experience has shown that in the majority of cases it does not, and the question that almost invariably comes back is:

If the electron flow is the same as the current flow, and electrons flow from *negative to positive*, how can the current flow from *positive to negative?*

The following explanation and analogy has proven in class work to almost always settle the question in the student's mind, and it is given here for precisely the same reason.

Direction of Current Flow

When the assumption that current flowed from positive to negative was first made, electricity was used primarily for such purposes as lighting, heating, ringing bells and running motors. The effects produced by electricity were what we were especially interested in, and since no means were at hand to definitely prove which way the electricity was flowing, it was assumed to be from positive to negative, and this flow was called an *electric current.* This direction was probably decided on because the prevailing theory at that time likened the electric current flowing in the wire to the flow of water through a pipe. And since water flows from a high level to a low level, and we generally assume positive to be high compared to negative, the assumption for the direction of the current was the most logical one to make.

When electrons were discovered, however, it was soon proved that they were the only things actually traveling in the conductor, and that they did not move from positive to negative but from negative to positive. But this discovery did not change the effects produced by the electricity as it flowed through the various circuits. Lights still burned as before, heaters still got hot, bells continued to ring and motors continued to rotate without any difference in their action whatever. Apparently, then, from a practical standpoint, the knowledge of electron flow made no difference. But it did help from a theoretical point of view, because it enabled us to more accurately predict how certain circuits would act.

During the time that the fluid theory was in use, many rules and formulas were evolved to fix, for example, the relative direction of magnetic flux and the direction of the current causing it; or the direction of rotation of a motor when the direction of the currents through the armature and field circuits is known. All of these rules were based on the assumption that current flowed from positive to negative, and by the time the electron flow was found these rules had become so thoroughly fixed in electrical science that it was not practical to change them.

How, then, shall we retain these rules and at the same time state that electron flow is opposite to the direction of current? By continuing to assume that current flows from positive to negative, of course. So far, so good. But now comes the statement that the electron flow and the current flow *are one and the same thing, but opposite in direction to each other.*

To help to visualize what is going on in the circuit let us consider this illustration. When it is said that a current flows along a wire from positive to negative, what is really happening is that the electrons are moving from atom to atom of the wire in a direction from negative to positive. They move in this direction because the electrons are themselves a negative charge and therefore the positive charge toward which they move atttracts them, while the negative charge from which they move repels them.

Now, as they jump from atom to atom they leave a positive charge on the atoms they just left, while the positive charges on the atoms to which they have just jumped have been neutralized by their own negative charges. In other words, the position of the positive charge in the circuit moves from in front of the electron to behind it as the electron moves along, and the change of the position of the positive charge is caused by the motion of the electron. Now, a positive charge on an atom is caused, not by adding anything to it, but by taking an electron away from it. Therefore, nothing has moved in the direction of the positive charge except a condition, which condition is caused by the movement of the electron in the opposite direction.

To further illustrate this point take the following analogy, which may appear rather silly but nevertheless usually gets the idea over. Suppose we have a row of rocks with a frog sitting on each. If the frog on rock number one jumps to the bank his rock becomes vacant. Frog number two then jumps to rock number one and as he does so the vacant condition moves from rock number one to rock number two. This is in the *opposite* direction to that taken by the frog.

If number three frog now jumps to rock number two, the vacant condition moves in the opposite direction to rock number three. In the whole picture what has moved? Nothing, actually, except the frogs. But due to the motion of the frogs the vacant condition moved in the opposite direction. Yet the vacant condition is nothing but a lack of a frog on a rock.

Now to tie this up with the electrons and the atoms. Let the frogs represent the electrons moving from negative to positive, and let the vacant condition of the rocks represent the positive charge on the atom moving from positive to negative, or opposite in direction to the

(*Continued on next page*)

From I.P., May, 1933

'Ground' Testing Made Easy

By M. D. O' BRIEN

OF ALL projection troubles none is more difficult to solve and more productive of unnecessary expense than the "ground." A ground will begin to build itself up in the most unlooked-for places and when least expected.

Arc lamps are a common source of grounds. Here the constant consumption of carbons creates and deposits over the entire lamp a certain amount of current-carrying ash which adheres like talcum powder and covers both metal parts and insulated joints.

When a slight coating of carbon ash stretches from current-carrying metal across mica and fibre insulators to the frame of the lamphouse, a path is established for the flow of current which in its early stages has a reasonable amount of resistance.

In systems employing straight D.C. as a source of supply, however—and particularly where a grounded neutral is part of the system—this slight ground can set up sufficient arcing from current-carrying parts to the grounded frame of the lamphouse to seriously burn and melt the metal and even destroy the insulating properties of mica. Such a condition would constitute a "dead short-circuit" (depending upon which polarity of the lamp is grounded), and would necessitate complete disassembly of the lamp burner to replace defective parts and insulators.

Supposing this should occur during a performance? Needless to say, the resultant interruption of the performance with its attendant refund and inevitable loss of prestige would seriously injure the goodwill which had been built up by a theatre over a long period of time. Repair expense is, of course, an important factor, but this item cannot be compared in importance with probable loss of prestige.

In the case of a theatre employing motor generators as a source of power supply to the lamps, the slight depositing of carbon ash may in time build up to a current-carrying path having very little, if any, resistance value—and without being detected. This is possible because of the generator leads being entirely isolated from a "true ground."

But should a ground develop on that polarity of a generator opposite to that which was formed in the lamp burner, not only will serious damage to the lamp result but the generator may be temporarily put out of service by reason of its fields or armature being burned out. In the event that a theatre is equipped with but one generator, there can be only one result—complete shutdown.

The foregoing emphasizes anew the urgent necessity for constant inspection and cleaning by the projectionist of the lamp burners and the lamphouse.

A majority of projection rooms today are equipped with a portable voltmeter. Ten minutes of your time with this handy little instrument is all that is required to determine positively whether current-carrying parts are ground-free.

A handy little ground detector which may be permanently installed in the projection room can be made up of two lamp sockets and two lamps. Connect the two lamp sockets in series across the positive and negative busses of the generator supply panel. Then run a lead from the center of the two sockets to a good mechanical ground (water pipe, etc.). Insert a clear 25-watt Mazda-type filament lamp in each socket.

Under normal conditions both lamps will burn with equal brilliancy. But should a ground develop on one leg of the service, that lamp which is connected to the opposite polarity will burn more brightly than the other. By the simple process of opening one projector, or spot, switch at a time it is a comparatively easy matter to determine which circuit is grounded. Should all switches be opened and a ground still be evident in the detector, this will indicate that the generator or its circuit is grounded.

If some such device as this is utilized, you will enjoy the advantage of a continuous ground detector—constantly in full view.

A "swinging ground" will be indicated through this device by an intermittent change in the brilliancy of the two lamps. If so desired, a fuse may be inserted ahead of each lamp to serve as a further precautionary measure. However, this is not absolutely necessary.

The ground detector device described in the foregoing is not suitable for use on 3-wire, grounded neutral systems.

From I. P., May, 1932

Arc Light Factor Calculation

TO FIND the light factor of your arc, multiply the illuminated area of your screen in square feet by the average intensity in foot-candles to which that screen is raised, and you will arrive at the lumens being projected thereon. For example, you would be using 3,740 lumens to get 10 foot-candles on a screen 22 feet by 17 feet. Supposing that your arc was using 75 amperes at 55 arc volts, your wattage would be 4,125, and you would therefore be obtaining approximately .9 lumen on the screen for every watt consumed in the arc.

Now, it is this ratio of lumens to watts that is the important thing, because by reference to this figure you can determine the electrical efficiency or light factor of your carbons.

Supposing, in the example we have just taken, that you fit another pair of carbons, and find that for the same arc wattage, you can obtain 12 foot-candles. Your lumens will now be 4,488, and your light factor will be 1.0 lumen per watt. Conversely, if you found that with the new carbons you could still get 10 foot-candles for an expenditure of only 70 amps., 50 arc volts, your wattage would be 3,500, and your light factor at 3,740 lumens would again be approximately 1.0 lumen per watt.

Having therefore determined the light factor of your carbons, the next thing to consider is burning rate. If you burned two pairs of carbons of different make but of the same size for an hour, the difference in burning rate might not be very marked, but the slower-burning carbon may well give you an extra two- or three-reel run, and leave no appreciable waste end.

Naturally, the most accurate check of screen illumination is to be had through use of a photometer, but very few theatres have such a device. In the absence of such equipment, however, the foregoing information will serve the purpose admirably. Many projectionists try to estimate costs merely by a comparison of carbon prices, without regard for the factors of burning time and "juice" costs, which are absolutely necessary for any fair evaluation of costs.

From I. P., September, 1933

Relation of Electron Flow to Current Flow

(*Continued from preceding page*)

electrons. But the positive charge is nothing but a lack of electrons on the atom.

Definitive Terms

Now, if we must have something to pin our imagination to in order to understand electron flow and current flow, think of the motion of the electrons as the *electron flow,* and the motion of the positive charge from atom to atom as the *current flow.* That is, as a matter of definition, let "current flow" mean the motion of the positive charge around the circuit, and "electron flow" mean the motion of the electron around the circuit.

Current, flowing from positive to negative, is measured in amperes, which is just another way of saying that it is measured in coulombs-per-second. The coulomb is the unit of electrical quality. It takes about 6,290,000,000,000,000,000 electrons to equal one coulomb, so if that many electrons passed a given point in the circuit in one second of time it would be equivalent to one coulomb-per-second passing that point, or as we usually say, the current is one ampere.

Since the more electrons there are passing the point per second the more amperes there are flowing, it can readily be seen that the so-called current flowing from positive to negative depends entirely on the flow of the electrons from negative to positive, both as regards the *direction* of flow and the *value of the current in amperes.*

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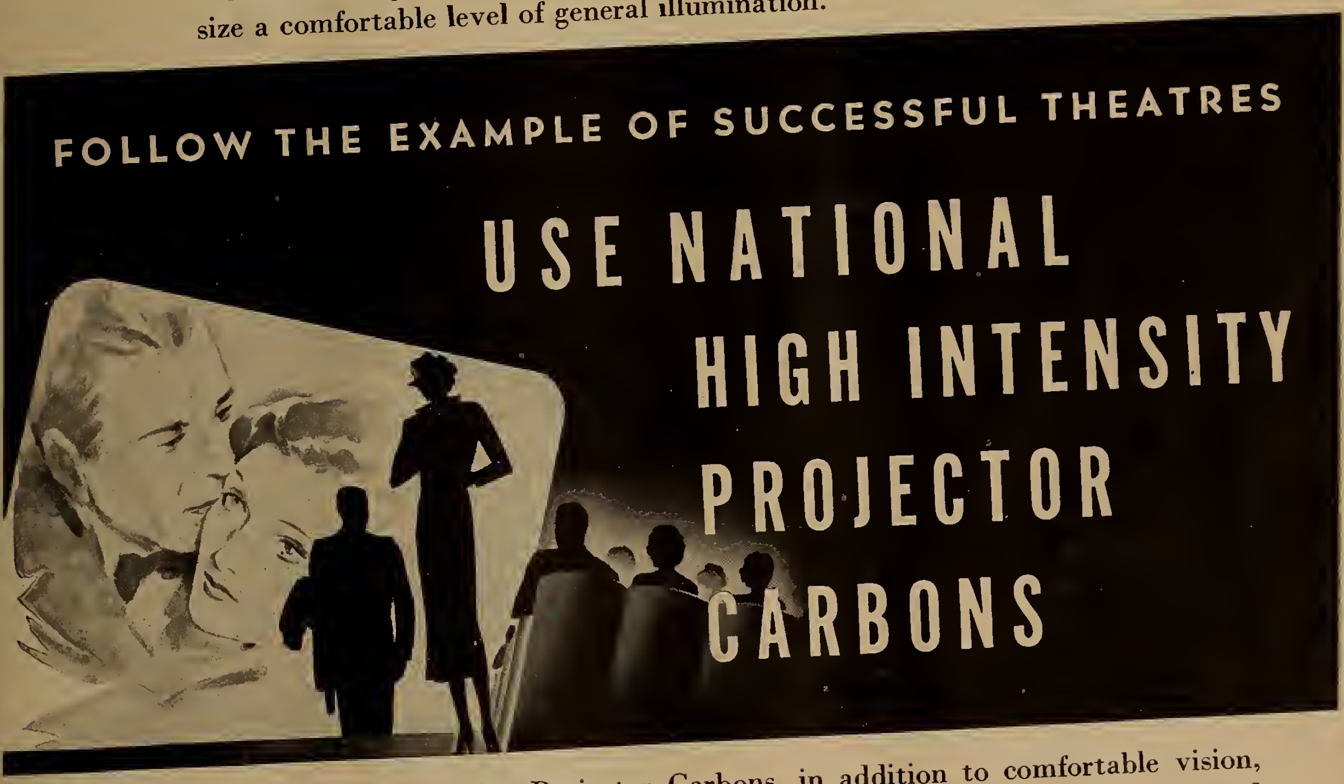

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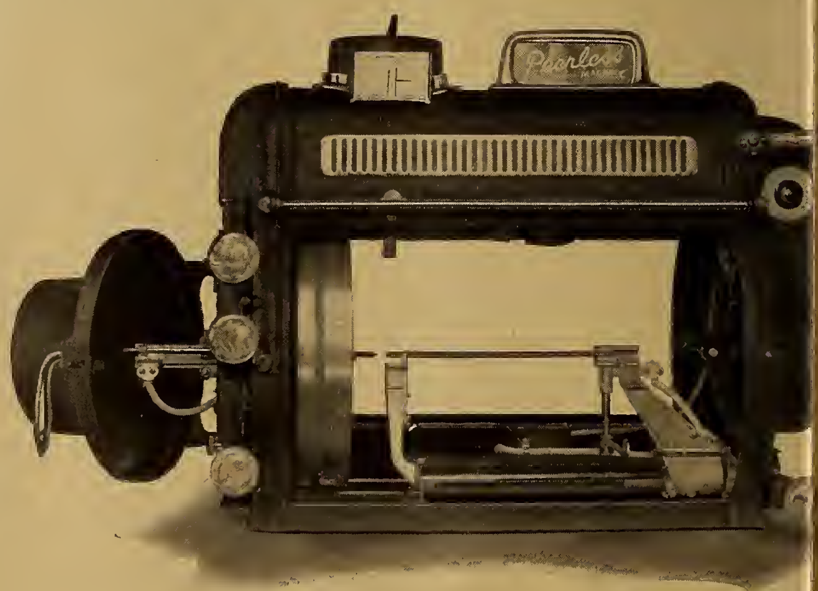

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"THE WORLD'S LARGEST MANUFACTURER OF PROJECTION ARC LAMPS"

Color Systems Must Recognize Projection Requisites

By GERALDINE GEOGHEGAN

★

Renewed activity in color film production directs attention to this medium as a means for providing the box-office "punch" generally held to be necessary to a reawakening of public interest in the art. Heretofore, production processes have monopolized the attention of color film technicians, and projection has been considered only in connection with a means to compensate for inherent deficiencies in a given process. Directly opposed to this procedure is the opinion expressed in the accompanying article, which holds that no color film system may be successful until it provides specifically for the projection process.

MOTION pictures in natural color seem to have developed in a somewhat jerky fashion. It is quite common among the various concerns dealing with color to have an expert on one or two subjects concerning the many problems arising in natural color photography, but, generally speaking, these experts are concerned only with their particular specialized knowledge and can offer little or no help when outside problems upset their calculations.

If the color is produced by an optical arrangement, an expert in optics is employed; if by dyes, a specialized color printer, etc. It is quite possible that these men can, and do, produce motion pictures of astounding beauty and fidelity to color under the *standardized conditions of the laboratory*; but when these prints are used commercially considerable trouble arises.

When we consider that color is not part or parcel of the article observed but merely its capacity to absorb and transmit such part of the light waves that fall upon it, we are up against our first problem—the spectral quality of the "taking" light. If the latter wavers in wave-length in the slightest degree, the object being photographed changes its hue. At the same time the human eye is an accommodating organ and has a very short memory, so that if such changes be gradual, it is impossible to notice them while under the influence of altered light; but, if the same observer and object again be placed under the correct light with an image taken under deficient light, the error can be detected immediately.

It is common knowledge that it is very difficult to produce artificially a light with a spectral approximation to daylight of sufficient volume without heat and noise. Even if this be done, the producer of color films is immediately up against another problem, the spectral quality of the "projecting" light.

After all, a color transparency is merely a collection of light filters that absorb and transmit, according to their power, the light that is projected through them. Therefore, we can deduce from this, that to obtain pictures on the screen in natural color, the "projecting" light and the "taking" light *must be one and the same spectrally*. Compensation may be attempted, but all filters lower the volume of illumination.

Let us say, for the sake of argument, that we have our taking and projecting lights spectrally balanced: minor problems now arise, such as the absorption and transmission of the screen, the influence of color in the decoration of the theatre, and the general quality of the approach lights. Some attempt should be made to screen all interior lights so that they approximate in quality that of daylight where neutral color films are to be shown, and only subdued schemes of decoration should be permitted.

The problem of voltage plays a part in projecting that does not arise with monochrome work. It would be quite possible for a motion picture in natural colors to be shown in one theatre with exceedingly pleasing and beautiful results, while its exact duplicate might be shown elsewhere with distorted and repulsive colors, owing to a drop in voltage.

One has to consider that on the stage, where living actors and actresses appear, the colors of the dresses and the lights that play upon them are under the control of the producer. He views the effect as the audience sees it, and is certain that no radical change can occur; but the producer of motion pictures in color is by no means in that happy position.

Monochrome pictures, once passed by their director and shown under ordinary standardized conditions, will please the man in the street, even if the expert technician will notice an error or so. But with natural color pictures it appears that a private view is necessary in every theatre in which each motion picture is shown, to see that no unforeseen spectral change has occurred.

It was found that many theatres were not suited for the sound pictures; some even had to be scrapped, and many altered. Why not, then, take the same precautions with color?

Undoubtedly color pictures will take the place of monochrome; but only by a very strict attention to what may be looked upon as minor details, can success be obtained. A change in gradation of tones in a monochrome picture can occur without any appreciable notice on the part of the spectator, but a change in color will be seen by every two out of three. The normal vision is trained to recognize objects not only by shape, but by color; it is not really familiar with these in monochrome, and therefore allows false gradation to pass unnoticed.

The writer has purposely ignored such problems as fringing, etc., as these are inherent in the processes themselves, and has adopted, merely as a theme, the difficulties that confront the producer, even though we have a perfect process of motion picture in color. It is doubtful whether such a process is yet on the market commercially, whence the path for color cinematography is beset with many thorns and snags. But at the moment it is felt that too much thought and research work are being directed to emulsions, optics, etc., which, although of themselves invaluable, are useless unless the same care be taken with light, etc.

It would be a better box-office proposition to have color fantastically unreal than to show (as has been done in many cases) true color degraded and falsified by bad technic.

From I.P., January, 1933

'The Only Thing That Counts'

The placing of an image on the screen is the last phase of this business, yet, in fact, it is *the only thing that counts*. I do not care what technical theories are involved, the only thing that interests the exhibitor is what he shows to his patrons—the finished job as it looks on his screen. Projection is the vital link between production and exhibition, and unless the standard of projection is such as to get out of the picture everything that there is in it, we might just as well close up shop and go out of business.

M. A. LIGHTMAN, Past-President
Motion Picture Theatre
Owners of America

From I. P., September, 1932

The Professional Projectionist

By A. N. GOLDSMITH

ONE definition of a craft is "an occupation or employment." A "profession" has been defined as "any calling or occupation involving special mental and other attainments or special discipline." There are reasons worthy of consideration for regarding the delivery of pictures and sound to the theatre audience as of such nature as to justify designating projection as a profession.

The final step in the processes of picture (and sound) production and exhibition is the projectionist's work. If the theatre equipment is in poor condition, or if it is inexpertly handled, audience satisfaction is jeopardized. The labor, materials, and expense which have accompanied the making of the picture (including, of course, the work of the author and of those who have adapted it to cinematic needs) the cost of making and delivering prints, and the expense of operating the theatre and advertising the production in question may, in an extreme case of apparatus inadequacy or unskilled projection, be lost so far as the audience is concerned.

From I. P., May, 1933

Audience Is the Judge

Since the audience is the direct source of whatever financial support the industry enjoys, and since the continuance of the activity of every branch of the industry thus depends on audience satisfaction, it is obviously poor policy to economize unwisely in the fields of projection personnel and their equipment.

It is likely that it is particularly hazardous at this time to risk displeasing the audience. Audiences today are made up of many persons who may be nervous, harassed, and insistent on being presented with so perfect and compelling an illusion that they are, in effect, transported to another world where their daily problems may be forgotten. It is for this psychological release that they make a bargain at the box office—and they are impatient if the bargain is not kept. It is not intended to minimize the fundamental importance of all the other processes and activities, but it must be insisted that the profession of projection takes its place with those other, and more generally mentioned and understood, professions which are involved in the world of pictures.

There is one aspect of the work of the projectionist which has not been emphasized so strongly as it might be, and that is the recurrent need that the projectionist shall meet small and great emergencies promptly and effectively. If the projectionist were serving a few people at a time, his promptitude and effectiveness would be relatively unimportant. But, considering that hundreds or thousands of persons have their attention concentrated on his work, any

(*Continued on page* 38)

★ Factors Affecting the Useful Life of Screens ★

ONE cubic inch of air contains 150,000 particles of dust. In cities a large part of the dust is coal and soot. The burning of one ton of coal releases 20 pounds of soot and dust containing sulphuric and hydrochloric acid. Dust and soot destroys everything it comes in contact with. A sound screen is porous. The air goes through the screen, and the dust and dirt stays on the surface. As time goes on the density of the dust accumulation is increased to a point where it becomes conspicuous as black streaks, smudges and discolorations.

In the winter, the stage or platform is generally colder than the auditorium. The screen becomes chilled, resulting in a slight condensation of moisture on the surface. Although the condensation may not be perceptible to the eye or the touch, it is sufficient to cause the dust in the air to adhere to the screen. Dust forms a film on the surface of the screen, and each day this film gets thicker until it is a dark gray in color. As the dust gets thicker the projected screen light gets dimmer, the picture becomes dull and hazy, and it becomes increasingly difficult to get the picture in sharp focus.

The gradual loss of light brilliancy due to dust makes it necessary to gradually increase the amperage at the arc. This means shorter life to the carbons, and a greater current consumption. Dust also filters into the tiny sound holes, gradually closing them up, or at least reducing their size. This means a loss of sound volume in direct proportion to the extent to which the holes are clogged. As the dust gradually clogs up the holes, it becomes necessary to increase the volume of sound. This causes added strain on the tubes and batteries, shortening their life. When more current is applied to the tubes in order to force the sound through the clogged up sound holes, overloading is inevitable, resulting in unnatural, distorted sound quality. Sound screens can be cleaned, but it is a process that requires skilled help to make it successful. All there is to say on this topic is said in the following statement:

"There is no satisfactory way of cleaning a screen despite many assertions that screens can be washed. Considered from the purely technical angle, it is impossible to wash a screen. The fabric itself is washable and can be cleaned easily, but it is almost humanly impossible to remove all of the dirt from so large an area, evenly and uniformly, without leaving streaks.

"The question of cleaning resolves itself down to the ability of an individual to remove the dirt *uniformly* from a large area. The particular cleanser used has very little bearing upon the subject, as a screen can be washed with equal results with any reliable soap dissolved in warm water, the solution being applied with a sponge and the screen rinsed off with clean water. *Good results apply only to small areas, however.*

"Every major circuit has devoted a great deal of time to cleaning of screens. The most satisfactory means found to date is to brush off the screen with a fine goat's hair brush at least once a week from the time it is installed. In this way the surface can be kept fairly free of dust. In case a vacuum cleaner is available, excellent results can be obtained by reversing the action of the cleaner and blowing the dust and dirt off the screen from an angle."

While opinions vary as to the life of a sound screen, it has been definitely established that discoloration caused by age, dust and dirt reduce the reflection value an average of 10% every three months. This makes a total of 40% in a year. In cities and manufacturing centers the loss in reflection value is even greater. The importance of this loss can well be understood if it is considered that the average perforated screen, when new, has a reflection value averaging 75%. Under extremely favorable conditions, this represents 10 F. C. (foot-candles) in each sq. ft. of the screen. A 40% loss in reflection value means reducing the screen illumination to 6 F. C. per sq. ft., or practically cutting the brilliancy of the picture in half.

The projectionist and the house staff become so accustomed to the appearance of the screen that they do not realize the gradual loss of light that is taking place day after day. Loss of light begins as soon as the screen is installed, and continue to accrue as long as it is in use.

The conditions obtaining at the theatre with respect to the care given the screen, the dust in the house, chemical conditions of the atmosphere, etc., all control the useful life of the screen. It is safe to say, therefore, that the maximum useful life is from 18 months to two years, though it can be readily proven that the majority of theatres would save considerable money in current and carbon consumption if the screen were replaced at least once a year.

From I.P., September, 1933

IMPROVE PROJECTION EFFICIENCY
With The New G-E Copper Oxide Rectifier

The new G-E Copper Oxide Rectifier is especially designed for projection lamps using Suprex carbons. It operates indefinitely without attention or replacement. The output is extremely smooth. Available in two sizes: 40-50 amperes for the 6-7 mm. trim and 40-65 amperes for the 6.5-8 mm. trim. G-E Copper Oxide Rectifiers are of proven reliability and economy. Their overall efficiency is conservatively rated at 70 percent. Such high efficiency saves from 5 to 10 cents per hour in cost of current over other types of D-c. power equipment. It will pay for itself in a year or two in current savings alone. Mail the coupon today for complete information.

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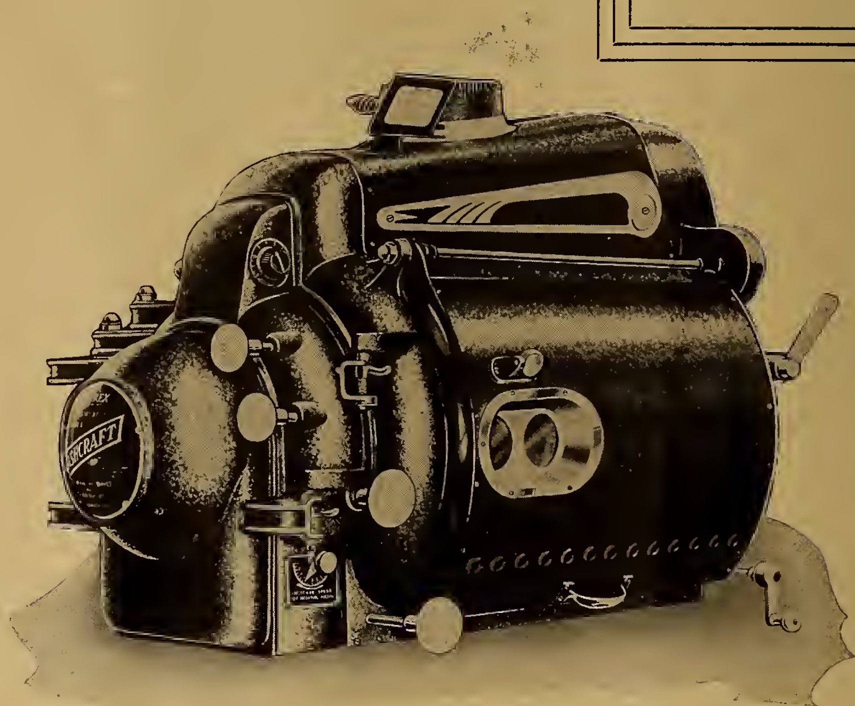

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- CARBON holder holds full 12″ trim at single setting—All mechanisms and control apparatus mounted to rear of the mirror on swinging door.
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For YOUR Protection:

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★ ★ Perforations in Sound Picture Screens ★ ★

TO THE audience in a motion picture theatre, the screen is the most apparent element in the projection of a picture. Before the introduction of sound, the screen's sole purpose was to serve as the source of visual stimuli. At present, however, its functions are two-fold as it must serve in an acoustic capacity as well. With loudspeakers behind it, the screen must now faithfully transmit to the audience the sound impulses accompanying a visual portrayal.

The characteristics of sound motion picture screens have been discussed by H. F. Hopkins in a paper appearing in the S. M. P. E. *Journal* for September, 1930. He explained that a screen can transmit sound in three ways: by motion as a diaphragm, by direct passage of acoustic energy through perforation or pores in the material, and by wave motion within the material.

The last method is of comparatively minor importance; and it turns out that most of the acoustic power originating on one side of the screen is transmitted to the audience by the first two methods. At low frequencies, diaphragm action induced by the acoustic power generated in the loudspeakers is the effective agency for the transfer of sound. In this case, the screen acts as a secondary radiator. At high frequencies, holes punched or woven into the screen are the effective means for sound transmission.

Mr. Hopkins discussed these factors in detail. Other work done since the paper was written substantiates his observations on the importance of perforations or holes in the screen. Some measurements made at Bell Telephone Laboratories are of interest in this connection. Tests were performed on a series of screens identical in all respects, save that the number of perforations was varied from zero to a condition whereby the perforated area comprised 9 per cent of the total screen surface. It was found that as the amount of perforation was increased, the reduction in acoustic power caused by the presence of the screen in front of the loudspeaker grew gradually less.

In other words, the screen became more acceptable with increasing amounts of perforation. As was expected, the influence of the perforations was most manifest at high frequencies. Table A shows the results of the measurements with the screen losses expressed in decibels.

TABLE A

Frequency	*Transmission Loss—db* Perforation: 0%	4.4%	6.8%	9%
55	.5	.5	.5	.0
100	.5	.5	.5	.0
200	.5	.5	.5	.0
500	.5	.5	.5	.0
1,000	3.0	.5	.3	.0
2,000	6.7	.7	.5	.5
4,000	11.0	2.0	.7	.8
6,000	14.5	3.0	1.0	1.2
8,000	18.0	4.5	2.3	2.0
10,000	20.5	6.0	3.8	3.0

The very real efficacy of perforations is shown by the table. At frequencies below 1,000 cycles, the improvement is slight; above this point the contrast between the screen with no perforations and that with perforations corresponding to 9 per cent of the total surface is very marked. At 10,000 cycles, for example, there is a difference of 17.5 db.

From an optical viewpoint, of course, it is essential that the perforations be maintained at a minimum and that their size be small. Present types of screens represent satisfactory compromises between the optical and the acoustical requirements.

The thickness of the screen and the diameter of the perforations or other holes are also factors requiring consideration from an acoustical viewpoint. Acoustical theory—a detailed discussion of which is beyond the scope of this article—indicates that the ratio of the thickness of the screen to the area of the individual openings should be small for efficient transmission of sound energy. All these factors must be considered in designing a screen in order to produce a product that is commercially acceptable.

From I.P., June, 1933

Effect of Various Colored Lights on the Appearance of Colored Objects ★

THE first column gives the color of the object or scene on the stage. Across the top line are the colors of the floods or spots. Under each color down the column are the effects that particular colored light will produce for each colored object. Look down the column until you find the color of the object; then run across the chart until you find the color you want to use; then run down the column until you are opposite the color in the first column — which will give the correct answer.

	COLOR OF LIGHT ILLUMINATING OBJECT OR SCENE					
True color of object or scene	RED	Use Red & Amber to make ORANGE	Use Amber & Green to make YELLOW	GREEN	BLUE	Use Red & Blue to make VIOLET
BLACK	Red Black	Orange Black	Yellow Black	Green Black	Blue Black	Violet Black
WHITE	Red	Orange	Yellow	Green	Blue	Violet
GRAY	Red Shade	Orange Shade	Yellow Shade	Green Shade	Blue Shade	Violet Shade
RED	Red	Scarlet	Orange	Brown	Purplish Black	Reddish Purple
ORANGE	Red	Orange	Yellow	Greenish	Black	Black
YELLOW	Orange Red	Orange Yellow	Yellow	Yellowish Green	Greenish Black	Black
LT. GREEN	Red Shade	Yellow Green	Greenish Yellow	Green	Blue Green	Bluish Shade
DEEP GREEN	Black	Greenish Black	Yellowish Green	Green	Greenish Blue	Blue Black
LT. BLUE	Violet	Dark Grey	Yellowish Shade	Blue Green	Blue	Violet
DEEP BLUE	Purple	Blue Gray	Grey	Blue Green	Blue	Blue Violet
VIOLET	Reddish Black	Red Purple	Grey	Blue	Violet Blue	Violet
PURPLE	Red Shade	Red Shade	Red Shade	Black	Blue	Violet
ROSE	Red Tint	Red Tint	Red Tint	Greenish Black	Blue Shade	Violet Shade

From I. P., May, 1934

Example: On the stage is a light blue object. If a red spot is used on it, it will appear Dark Gray. If the object is Orange, and a blue flood is used, it will appear Black.

An understanding of color combinations is essential to any serious projection effect work.

Practical Policies

1. Don't *force* your projector when it seems stiff. It may need oil, or an obstruction may have found its way into the working parts—such as a loosened pin or screw.
2. Don't use alcohol, benzine, kerosene or turpentine as a lubricant. A first-grade, medium-body oil is recommended.
3. Don't try to put enough oil into the mechanism at one oiling to last a week; use less oil and use it oftener.
4. Don't forget any of the oil holes. They are there for a purpose and every one of them is important. Locate each one on the instruction plates.
5. Don't fail to keep lenses and condensers clean at all times.
6. Don't use a rough cloth or waste to clean optical units. A piece of chamois, linen, or soft cloth moistened with ammonia will give the best results, and remove all dirt as well as giving a high polish. Use equal parts of ammonia and water.
7. Don't fail to examine all electrical connections on lamp, rheostat or motor. For any electrical device to be efficient all connections must be firmly tightened.

The Third-Dimension in Motion Pictures

By HUGO LATELTIN

THE practical realization of three-dimensional motion pictures apparently still is beyond the reach of serious workers in the art. Many attemps to attain this goal have resulted in numerous "systems" the failure of which is foreordained because of their being either impractical or too costly. Even a casual review of scores of patents already granted covering stereoscopic motion pictures induces amazement relative to the ludicrous conceptions underlying a majority of them.

The work done to date in the field would seem to lend strength to the opinion that the solution of the problem lies in ignoring all "trick" processes and concentrating on the work of faithfully copying the natural conditions inherent in three-dimensional vision.

What is the outstanding problem the solution of which will lead to a satisfactory stereoscopic motion picture? On the basis of the work done to date, it is obvious that a successful stereoscopic process will have to satisfy the requirements of *binocular vision*. As far as careful checking can determine, there is available today no satisfactory means for the production and reproduction of stereoscopic pictures, but the results of a recent series of tests hold out some hope for attainment of this result. But let us consider binocular vision.

First, separate pictures representing the right eye and left eye views must be taken, and second, each eye must see only its appropriate picture. Outstanding workers in the art are agreed that there can be no departure from these requisite fundamentals, if success is to be attained. Several methods have been employed to obtain this result.

The *anaglyph method* utilizes red and green filters positioned directly in front of the observer's eyes. The left eye and the right eye views on the film are alternately colored in red and in green. The observer's eye before which is placed a green filter will see those pictures which are colored in the complimentary color —that is, red. This arrangement insures that the eye will receive only its appropriate view.

In the *stereoscope method* two images are projected side by side upon a screen, and these, are viewed by an ordinary stereoscope.

The *polarized light* method polarizes the light of the left eye in one plane and the light of the right eye view in a plane turned 90° toward the former. When observed through a polarizer in front of both eyes, each eye will see the view indigenous to its position.

The *eclipse method* projects alternately left and right views and uses a revolving shutter near the eyes which runs in synchronism with the film, cutting off the right eye view from the left eye and *vice versa*.

None of the foregoing methods has been found practical for general application. The common handicap is the necessity for providing each observer with a suitable analyzing device, the elimination of which is the goal of all investigators in the art. Recent research work looking to this end offers great hope for the not too distant future, and, in fact, still pictures which reflect a thorough understanding of the fundamental requirements for stereoscopic motion pictures are now available.

H. E. Ives of Bell Telephone Laboratories has given a concise and extremely clear exposition of the problems involved in the production of three-dimensional motion pictures[1]. While expressing grave doubt as to any great immediate advance in art, the Ives presentation is crystal-clear in its enumeration of the factors involved in working out the problem of three-dimensional motion pictures.

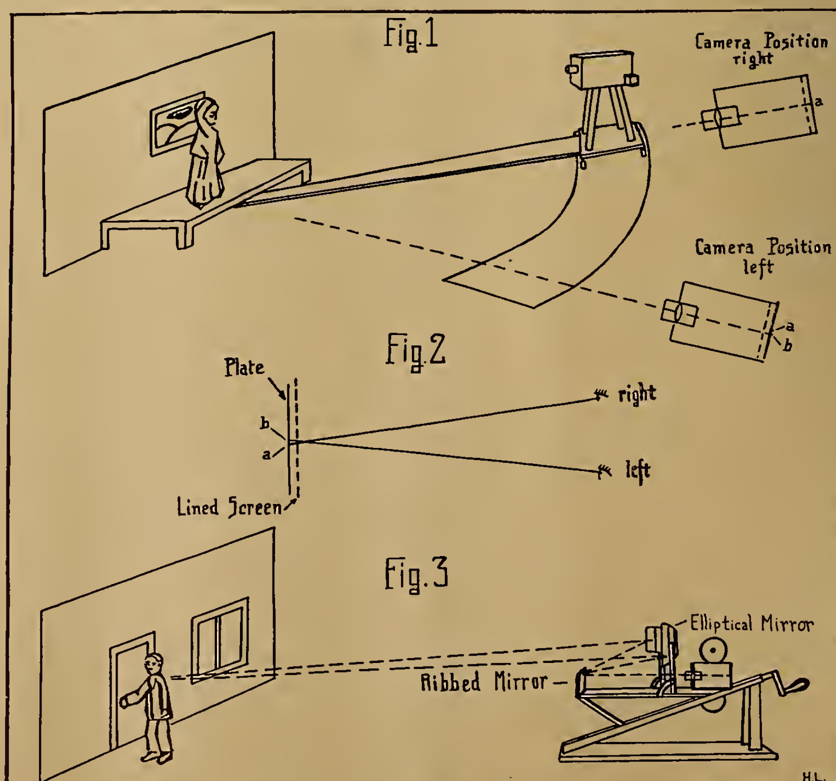
Of considerable interest is the fine work done by Dr. Kanolt, of the Perser Corporation[2], who has devoted many years exclusively to the study of stereoscopic still and motion pictures. Dr. Kanolt holds numerous patents relating to the art, one[3] concerns the application of his stereoscopic still pictures to motion pictures. His still pictures already are in wide use for commercial and scientific purposes. The Kanolt method might be designated "Parallax Panoramagram," the term used in the Ives paper previously mentioned. The efforts of Dr. Kanolt deserve particular attention, inasmuch as his work with still pictures proves beyond a doubt the sound basis upon which he has builded.

Before considering the "Parallax Panoramagram," let us consider the method used in making still pictures. Figure 1 illustrates the arrangement for taking stationary photographs. A

[1] "The Problem of Projection Motion Pictures in Relief," by H. E. Ives. Journal of the S.M.P.E., April, 1932, Vol XVIII, No. 4, p. 417.

[2] New York City.

[3] U. S. Patent 1,882,648.



From I. P., Dec., 1932

camera, mounted on a carriage, is moved in a semi-circle around the object to be photographed. The angle described may be as much as 60°. The purpose of moving the camera around the object is to obtain a plurality of different views. As is shown, in the upward or right position of the camera, a ray of light proceeding from the center of the object is projected by the camera lens to the center of the photographic plate. In front of this plate is a lined screen consisting of a great number of narrow vertical strips. The open slits between these strips will pass the light to the surface of the plate.

'Shooting' the Picture

In the upward position of the camera the center ray meets the light sensitive plate at *a*. While the camera is in motion the photographic plate is slightly displaced horizontally to one side. This displacement equals the distance from one slit to the neighboring slit and is accomplished by means of an electric motor which turns a micromatic screw. When the camera has reached the left position, the point *a* on the plate is now covered by a strip of the lined screen and therefore is no longer exposed to light impressions. A center ray from the object will now meet the photographic plate at *b*.

Position *a* on the plate represents a right eye view, and position *b* a left eye view. Between these two positions there are a great number of separate exposures, all resulting from the motion of the camera around the object.

Motion Picture Applications

Figure 2 shows the actual viewing of a stereoscopic still picture produced by this method. The photographic positive is illuminated from the rear. In front of the positive is placed a lined screen, similar to that used in the camera. Figure 2 shows how rays from *b* on the plate enter the left eye, and those from *a* the right eye, thus making visible to each eye its appropriate view. The extreme narrowness of the slits makes it impossible for the right eye to see the left eye view, and *vice versa.*

The application of this method to motion pictures is impracticable, if not actually impossible, for the very definite reason that the time required for the exposure of one complete picture ranges from 10 to 60 seconds. Present-day motion pictures are run at a speed of 90 feet per minute, with each separate picture being allotted an exposure time of one twenty-fourth of a second. This means, then, the elimination of the motion of the camera around the object.

Figure 3 represents one possible arrangement for the taking of stereoscopic motion pictures. An elliptical mirror

(*Continued on next page*)

H. I. Arc Alignment

By SIDNEY WEIN

CONSIDERABLE light loss is occasioned in a high-intensity lamp for the following reasons: (1) negative carbon out of line with respect to the center of the condensers, and (2) condenser assembly lenses out of line with respect to each other. The accompanying illustrations indicate these deficiencies. In Figure 1, A shows the negative carbon too far to the left; B shows the negative carbon too far to the right; while C shows a perfect arc, the result of proper alignment. A and B sections of Figure 1 show the tail flame out of center, which condition means that the light is out of center with respect to the center of the condensers.

Centering the Light

To remedy this condition, the carbon-carrying carriage must be moved either right or left in order to directly center the light on the condensers. But when this is done, the center of the positive carbon is facing the center of the condensers out of true.

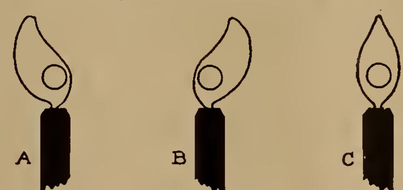


Figure 1

These shortcomings can easily be overcome in arc lamps having negative jaw alignments. In a majority of high-intensity lamps, however, the negative jaw assembly is usually bolted to the lamp carriage by means of insulated bolts or screws, which can be loosened, after which the negative jaw assembly can be tapped over either to the right or left to line up the carbons. When the work is finished, the bolts or screws should be tightened firmly again, a failure to do which will result in the jaws getting out of line again due to vibration.

Aligning Condenser Lenses

The alignment of condenser lenses requires care and attention to detail. The lens on the screen side is usually in a holder that cannot be moved in any direction, but the condenser on the arc side is in a holder that always can be moved back or forth, with respect to the distance between the arc and the front condenser, on a pair of rods or runners. In Figure 2, A indicates condenser lenses which are in line with each other; while B shows the condenser on the arc side out of line with the front condenser. The rear condenser is in a holder that is held onto the rods by screws, one on each side. It is well to loosen these screws and, using an aligning tool made from a piece of wire bent in the shape of an ell (L), one can line up first one side and then the other. When both sides are the same distance from the front condensers, the screws are tightened.

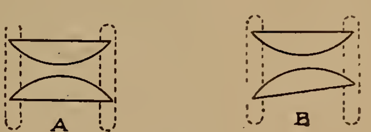


Figure 2

To sum up: the condensers should be in perfect alignment with respect to each other; the negative carbon should be in alignment with the positive carbon, and the center of the positive carbon should be in alignment with the center of the condensers. If these conditions prevail, one can be sure of getting not only the most light but the best light from high-intensity arc lamps.

Occasional adjustments and natural wear combine to wear out the mica insulation on the lamphouse. Periodical checks to establish the extent of this wear are very important in order to prevent possible "grounds" and short-circuits.

From I. P., April, 1933

★

Projectionists, sick of sex appeal, jungle lore and gunmen, wondering why someone doesn't make a film about food

★

THIRD DIMENSION

(*Continued from preceding page*)

concentrates the light received from different angles upon a ribbed mirror mounted in front of the camera. The elliptical mirror, which may be constructed of one piece or of a series of individual mirrors, makes unnecessary the motion of the camera around the object. The ribbed mirror, supplanting the lined screen used in the still picture process, has a surface with a great many fine ribs. It has the advantage over the lined screen in that it is not as wasteful of light.

Each rib receives all the different views obtainable by the elliptical mirror of a certain part of the scene to be photographed, and in turn will throw a narrow band of rays onto the moving film, each band corresponding to the multiple exposures produced between *positions a* and *b* as shown in Figures 1 and 2. If a film photographed by this method is projected onto the rear surface of a screen and viewed through a lined screen from the front, it will necessarily give depth to the picture.

The projector itself would remain the same as it is today, and only the screen would have to be changed. Instead of rear projection, seldom used now, front projection could be employed with the aid of a specially constructed ribbed screen enabling each observer to receive with each eye the view intended solely for it.

A number of other possible combinations come to mind, but it seems certain that all of them will employ either an elliptically-shaped mirror or a large lens, or lenses, to gather the varied views of the object. Prevailing economic conditions have seriously retarded the practical fulfillment of three-dimensional motion pictures, and there still remain ahead a number of years of intensive development work before a wholly satisfactory process will be at hand. It is certain, however, that past tests have established certain fundamental laws as a guide for future correct procedure.

The introduction of three-dimensional

Projector Mechanism Care

1. Don't use force in driving pins or removing shafts.
2. In removing intermittent movement be careful not to strike the sprocket against the sides of the mechanism.
3. Don't let the film trap door slam after threading, as the film may be thrown off the sprocket and ruined when the projector starts. Place finger against trap door and let it close easily.
4. Don't use steel to scrape the emulsion off the film trap and tension springs. Use the edge of a copper coin or other soft metal. Brass is okay.

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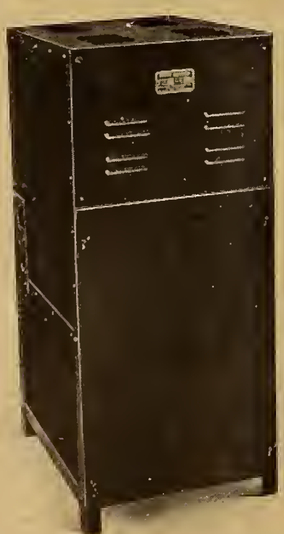

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pictures will affect the projectionist only to the extent that greater care and experience will be required. Undoubtedly the arrival of the stereoscopic motion picture will tend to improve the conditions under which the projectionist works, in line with the proven theory that stricter requirements tend to make the field more exclusive and open only to the trained men who, while able to keep pace with new developments, possesses a good background of years of experience.

Elements of the Eye

There are two parts in the perceptive elements of our eyes that function somewhat differently. The part concerned with direct vision is almost microscopic in size and is made up of minute terminal filaments something like cones. With these we get the details of the objects at which we look. It is this minute area that we use in reading or in getting the clearly defined outline of a distant object. If this is destroyed all accuracy of sight is lost. It does not function continuously. It perceives quickly but the impression fades with equal rapidity so that we actually see in a series of rapid flashes with intervals of about one-tenth of a second.

The surrounding field of vision is that which perceives objects at which we are not directly looking, but which are at one or the other side of us.

The Major Causes of Scratched Film

ALERT projection work and the very best of equipment kept in top-notch shape go for naught when scratched film is used. Scratching of film may be caused in various ways, but the two most important causes of scratched film are the projector head and the rewinder.

The projector head may cause scratching in one or more of the following ways:

1. Rollers in the upper or lower magazine are worn to such an extent that the tracks are on a level with the roller. The accumulation of dirt in the roller holder assembly will prevent the rollers from rolling and will cause wear on one side. Moving film riding down on a flat surface will cause deep emulsion scratches.

2. Worn film trap shoes result in the emulsion side of the film being scraped by the aperture plate.

3. Too much tension on the film trap door, trap door pads and shoes. Usually a combination of all these.

4. A mutilated, warped, nickel, bent or worn aperture plate. If an aperture plate shows even the least sign of wear, the projectionist can be certain that *his* projector has been the cause of many thousands of feet of film being scratched. Remember, scratch marks are cumulative.

5. A warped film trap (E-16) will also cause the aperture plate to become warped. Usually caused by excessive arc lamp heat.

6. Oversize top or bottom loops in the projector head, or oversize loop in the sound head.

7. Too much tension (in this case, pull) on the take-up.

8. Film running on sprockets, as a result of defective patches; worn sprockets and film guides; film guides out of alignment—or a combination of ills.

The rewind is a source of prolific scratching and tearing of film. Most of the comment which has appeared heretofore had to do with excessive rewind speed. Other rewinding faults are:

1. Testing film for bad scratches by placing the whole palm on the moving film (emulsion side is always on top). The proper way to test film is with the thumb on one side of the film, and the index and middle finger on the other.

2. Rewinding the film loose and then, while holding the dummy side of the rewind, taking up the slack on the moving side.

3. While rewinding film to suddenly apply the brake and let the motor continue to pull on the film. This results in more serious trouble than does No. 2.

4. Rewinder out of line. Bent reels.

From I.P., August, 1932

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THE PROFESSIONAL PROJECTIONIST

(*Continued from page* 30)

prolonged interruption or avoidable imperfection is shown up glaringly and creates a profound and unfavorable impression.

The meeting of an emergency may be a comparatively simple task in some instances, as for example in maintaining sharp focus of the picture. Yet it is an urgent task even in these cases. If, however, film breakage, equipment failure, or above all a film fire, should occur, the projectionist immediately becomes by far the most important person in the theatre. He can make or mar a reputation in a very few minutes; and in extreme cases he can prevent an appalling disaster or panic by cool and skilled work.

The cameraman and the sound recordist have duties of a nature roughly similar to those of the projectionist, except that each of them is required to concentrate only on *either* the picture *or* the sound, whereas the projectionist must concentrate on *both.* Focussing, centering the picture, maintaining or judging illumination, handling sound level controls, and maintaining electrical equipment in steady operation (with great financial and prestige loss in case of an interruption) are elements found in the work of both the studio men and the projectionist. It is worthy of mention that the camera man and the sound recordist are granted recognition and at least some brief fame through their honorable mention on the leader strip of the film.

The projectionist, on the other hand, enjoys anonymity. If the recital of the names of stage managers, painters of scenery and purveyors of shoes, on a theatre program is a justifiable procedure (and it probably is) it might be well to let the audience in a motion picture theatre know the names of the skilled projectionists who are steadily working for them "behind the scenes."

Many Diverse Duties

The nature of the routine work of the projectionist is readily enough defined. It consists in the maintenance of a bright, sharply focussed, centered picture free from travel-ghost, and the provision of clear sound of correct level and controlled tone quality. In addition, the care of the film while in the theatre devolves on the projectionist, together with such incidental operations as rewinding, patching or splicing, and the like.

The equipment for picture projection

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Running around the sound track.

Soothing syrup for teething sprockets.

Buzzing of the flywheel.

What to do for film on the sprocket teeth.

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Photo cells; or blinking the electric eye.

Vacuum tubes; or much ado about nothing.

Focussedness of the optical system.

Film tolerances and audience intolerances.

From I.P., March, 1934

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Simplex: $60 Motiograph: $55

The "De-Luxe"
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The "Super" Changeover: $40

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and sound reproduction must be well understood so that any repairs, except those requiring unavailable parts or special testing tools, may be rapidly made by him. He must cooperate with the engineer, the manufacturer, and the service man. In addition, a gift of oratorical persuasiveness is useful to the projectionist who is discussing the purchase of testing equipment, spare parts, or replacements for worn parts, with some of the less generously inclined exhibitors.

As will be gathered from the foregoing, the work of the projectionist enters the fields of mechanical operation and of optical, acoustical, and electrical principles and practices. To function intelligently he requires a good working knowledge of those portions of each of these fields which are applied in the equipment of the projection room and in the loud speakers on the stage—and this is equivalent to saying that he requires a fair appreciation of a considerable portion of the less complicated parts of these fields and also some knowledge of some more complicated matters. In any case, even an avid learner will not become a knowing projectionist overnight, quite apart from the acquisition of the manual skill and deftness which is required.

It is likely that the field of the projectionist will expand rather than contract as time goes on, and that the knowledge and experience he will require will increase as innovations in the field are introduced into the theatre. Color motion pictures will bring some problems of illumination, screen color and arc color in their wake. Three-dimensional pictures (if and when they arrive) will probably further tax his ability. Special sound effects along some lines not yet introduced in the industry will add to the complication of the projectionist's task. And it is at least conceivable that television reception and the projection of television pictures on the regular screen will add to the projectionist's training, his technical library, and his required skill.

The projectionist and the engineer should be closer to each other in the future. Many an engineer can get useful information and practical guidance in apparatus design and construction matters from the thoughtful projectionist. The service man can save time and get better results if the projectionist is interested in the equipment, communicates a clear statement of any symtoms of trouble, and suggests the probable cause of the difficulty.

TESTING CIRCUITS

(*Continued from page 7*)

this is the test lamp having two sockets and two 110-volt lamps which, being in series, are the equivalent of a 220-volt lamp.

Figure 8 shows such a tester which can be used to test both 110- and 220-volt circuits. Naturally, the lamps will not burn to full brilliancy on 110 volts. Sometimes a lead is brought out between the lamps so that it can be used with

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one of the outside leads when testing 110 volts. Only one lamp lights when they are used in this manner, and it burns brightly only if the voltage is normal.

Let us leave the test lamp for the time being and take up other methods of testing. The voltmeter as a test instrument has certain advantages and certain disadvantages. The chief disadvantages are the delicacy of a good meter and the cost if it is ruined. Replacing a burned-out test lamp is a matter of thirty or forty cents. The cost of the average meter will run from five dollars up. It is true that meters can be obtained for about a dollar, and sometimes less, but these are not used a great deal and then only for testing battery voltages.

A DC meter can be used only on DC. Some DC meters are now supplied with a copper-oxide rectifier, allowing them to be used on AC, but it is then considered to be an AC meter. Most of the AC meters can be used on DC as well, although they usually are not as accurate in such a case as the DC meter. On some types of DC circuits the AC meter cannot be used at all, even though the same meter can be used on other DC circuits.

Some of the advantages in using a voltmeter are that it *usually* shows nearly the exact voltage present. On low resistance circuits—such as power lines, battery circuits, etc.—any ordinary meter will show the voltage; but when testing high resistance circuits found in amplifier and power supply devices the ordinary meter will show only a fraction of the voltage that is *normally* present. The reason for this is that all meters require a flow of current through the instrument in order to give an indication; they are devices that consume power, and that power must be supplied by the circuit under test.

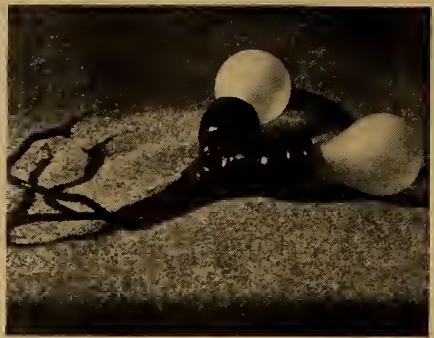
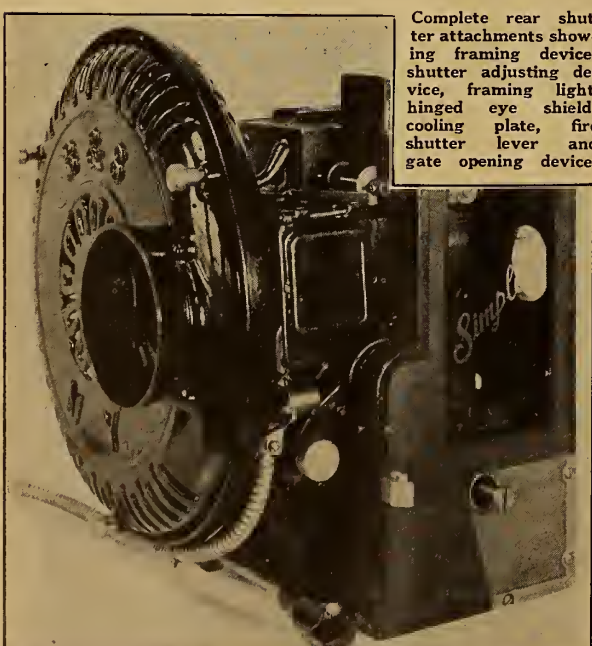


Figure 8

If the circuit we are testing has a comparatively great amount of resistance, there will be a large drop in voltage across it due to the current drawn by the meter. Usually there already is a current flowing: it may be the current taken by the plate of an amplifier tube. The purpose of the test might be to determine the voltage at the plate of the tube under working conditions. The current taken by the plate causes a drop in voltage across the resistance, and when the additional current taken by the meter flows through the circuit, it may upset the normal conditions to such an extent that a meter reading may be next to meaningless. When it is desired to know only if plate voltage is present at the tube, this indication is sufficient.

The full lines in Figure 9 show the plate circuit of a tube, and the dotted lines show how the voltmeter is hooked-in. Starting at the arrow marked "Pos. B," we see that the current must go up through the 100,000-ohm resistance, over to the plate of the tube, through the tube and down the wire to the arrow marked "Neg. B"; from here the circuit is completed through whatever the source of B potential happens to be. Notice that the tube and the resistance are in series: all current flowing through the resistance must also flow through the tube. The lead going to the next tube does not enter into this, since it does not carry DC. A condenser is placed in the line to isolate this circuit from the following tube.

Now consider the meter. It is connected from the plate to the filament of the tube, and the meter and the tube are connected in parallel. Any current drawn by the meter must be an addi-



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tional current coming through the resistance. In order to see why certain meters can be used and others cannot, let us analyze the conditions of this hook-up before and after the meter is connected.

First we re-draw Figure 9 so as to get it into a shape in which it will be easier to visualize what is happening. This new form is shown in Figure 10. Electrically it is the same as Figure 9, except that the meter has been left out. The plate to filament resistance of the tube is represented by a zig-zag line marked "10,000 ohms." This is the value that some types of tubes used in this position have, although it may be varied by changing the voltage applied to the tube. When the grid of the tube is not excited by a signal, the tube acts the same as would a simple resistance if placed in that position.

The total resistance from "Pos. B" to "Neg. B" is 100,000 plus 10.000, or 110,000 ohms. The voltage from "Pos. B" to

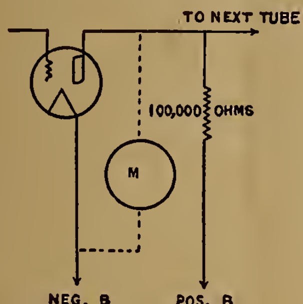

Figure 9

"Neg. B" is 130. Applying Ohms-law we find that there will be a current of .00118 amps., which is equal to 1.18 mils. A sensitive milliammeter would show this and make unnecessary mathematics. We are now ready to find the drop in voltage across the tube. Multiplying the plate resistance by the current (10,000 times .00118), gives us 11.8, the effective voltage at the plate. This is the voltage a meter would show *if we could get one that did not draw any current.*

Figure 11 (on next page) shows the circuit after the meter has been added. The resistance marked 3,000 ohms represents the meter. One type of meter used a great real in projection rooms has a resistance quite close to that value. Comparing Figures 11 and 9, we see that they are the same, except that we have used the symbol for resistance instead of drawing-in the tube and the meter.

Current coming from "Pos. B" flows through the 100,000-ohm resistance.

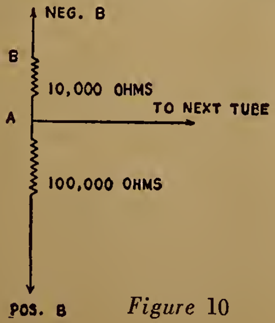

Figure 10

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From the point *A* there are two paths that it can take; either through the 10,000-ohm resistance, which is the plate to filament resistance of the tube, or through the 3,000-ohm resistance, which is the meter—the two resistances being in parallel.

To find the total resistance in the circuit we must first see what the resistance is from *A* to *B*, by dividing the product of the resistances by their sum. 3,000 times 10,000 equals 30,000,000. The sum of these resistances equals 13,000. Dividing 30,000,000 by 13,000 gives us 2,308, or 2,300 ohms in round numbers. Using Ohms-law again, we have the voltage, 130, divided by the total resistance. 102,300, giving us .00127, the answer being in amperes. Multiplying by 1,000 changes it to milliamperes, equaling 1.27 mils. (Mils. is used in place of the longer word, milliamperes.)

Knowing the value of the current, we can find the voltage at the plate. Multiplying the total resistance from *A* to *B* by the total current flowing, 2,300 times .00127, which equals 2.9 plus, we get the voltage at the plate *when the meter is hooked on as shown.*

Bear in mind that the meter does not show a wrong value of voltage. It indicates the actual voltage present when it is connected across the circuit; but

TABLE A	Without meter	3000-ohm meter	100,000-ohm meter
Total Resistance From A to B	10,000 ohms	2,300 ohms	9,090 ohms
Total Current	1.18 mils	1.27 mils	1.19 mils
Voltage at Plate	11.8 volts	2.9 volts	10.8 volts

when it is hooked-in *it changes the voltage*, the conditions not being the same as they were before the meter was used.

Notice that the resistance in ohms was multiplied by the current in amperes, which is .00127. Had the figure 1.27 been used, which is the number of mils., the result would have been incorrect. Ohms-law states that the resistance multiplied by the current equals the voltage—but the units to be used are the ohm, ampere, and the volt. If the current is expressed in mils., it must first be changed to amperes by dividing it by 1,000. Of course, the same thing is accomplished if mils. are used and the answer then divided by 1,000. However, if we are not familiar with this sort of work, confusion might result, and it will probably be better if we use the first method—changing mils. to amperes and *then* multiplying.

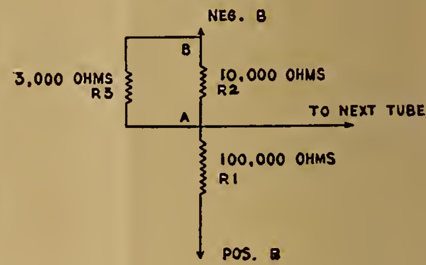
By using mathematics we found that the voltage at the plate of the tube is very close to 11.8. We then found that the voltage dropped to about 2.9 when the meter was applied. Needless to say, a meter that shows a reading of 2.9 when the voltage in the circuit is normally 11.8 is not of very much use. It shows the circuit to be continuous, but that is all. An open grid circuit, a defective tube, shorted condensers or resistances may often cause the voltage at the plate to actually be 2 or 3 volts, but the meter we have under discussion will not give an indication that can be depended upon to show such conditions.

This meter has a resistance about 1/3 that of the tube. If we used a meter having a very much higher resistance than the tube, it would not affect the result nearly as much as the low-resistance meter. Meters used for this sort of work are very sensitive and have a resistance of 1,000 ohms per volt. If the meter has a full-scale reading of 100 volts, its resistance will be 100,000 ohms. Let us hook such a meter into the circuit shown in Figure 11 and then see what are the results. Figure 4 can still represent our hook-up, if we remember that *R*3 is now 100,000 ohms.

Finding the total resistance from *A* to *B*, the product of *R*2 and *R*3 is 1,000,000,000. Their sum is 110,000. Dividing the former by the latter gives us a fraction more than 9,090.9 as the number of ohms when these two resistances are connected in parallel. We drop the decimal and use the number 9,090. As far as practical results are concerned this could be changed to 9,000, and this is what ordinarily would be done, being sufficiently close. This would also account for small discrepancies in results at times, but these may be overlooked.

The entire resistance in the circuit

Figure 11



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from "Pos. B" to "Neg. B" is now 100,000 plus 9,090, or 109,090 ohms. Dividing the voltage, 130, by this figure results in .00119, or 1.19 mils. 9,090 times .00119 equals 10.8, the voltage at the plate when we use the high resistance meter. The voltage with no meter in the circuit was 11.8, a difference of 1 volt, or about 9 per cent, close enough.

Making up a table using these values, we see at once what occurs when different meters are used (Table A). Notice the small differences in values in columns 1 and 3, as contrasted with the comparatively large differences in columns 1 and 2, and also in columns 2 and 3.

In testing for voltage at the plate of a tube in a transformer-coupled amplifier the high-resistance meter would read very nearly the normal voltage, since the resistance of the transformer primary is only a few thousand ohms and often is less than 1000. Under such conditions the plate voltage will be about 118 when the voltage of the B-supply is 130. Our high-resistance meter *would* read 116, but it only has a scale to 100 volts, so we must use a meter having a range of 250 or 500 volts. Either of these will read even closer to 118 volts than the 100-volt scale meter. Note that the meter reading will be less than 2% off.

The foregoing shows how important it is to use the proper type of testing device. The low resistance meter and the test lamp were O. K. for the line we were testing previously, but they are altogether inadequate for testing high-resistance circuits. The low-resistance meter gave a small indication at the plate, but the test lamp would give no indication whatever.

The high-resistance meters are O. K. for testing low resistance circuits, providing we use one having the proper range. The 100-volt meter would not do to test a 110-volt line, nor would it do for a 2-volt line. If a meter is wanted only for testing low-resistance circuits it would be needless expense to purchase one of the more sensitive type.

Maintaining Motor Generators

By A. C. SCHROEDER

(*Continued from page* 23)

carried around the commutator as far as possible. If the paper is used as in Figure 4, at A, the edges of the hrush will be too short, as at B.

After the brush is sanded, it is put in position and the machine run a short time—a half minute is sufficient. The brush then is removed and inspected to see how the fitting was done. Assuming that the shiny portions touch the commutator but the dull parts do not, the brush should be fitted some more. It does not take long to get the entire surface to touch.

Fasten Pig-Tail Securely

Be sure to fasten the pig-tail under the screw firmly. There have been instances where this was completely forgotten, with the result that the current had to flow through the spring that kept the brush against the commutator. This spring is not intended to carry current, and as they are usually made of steel,

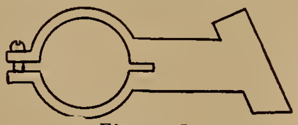

Figure 5

any great amount of current flowing through them produces heat, which is likely to draw the temper and render them unfit for further use.

Not only must the pig-tail be firmly fastened, but before it is put into place see that the surfaces are clean. These surfaces become oxidized, causing a rise in resistance at the joint, which condition will again force the current to go through the spring.

Care should be taken to insure that the brush holders are not moved from their normal position. They are often mounted as shown in Figure 5. If the clamp screw is loose, the holder can be twisted on the shaft. When one of the holders is twisted out of place the result is shown in Figure 6, where the right brush is farther down the commutator. Not only must these brushes he in line with each other, hut they must also be spaced equally around the commutator. This can bc ascertained by counting the numher of segments from the tip of onc

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set of brushes to the tip of the next set.

In Figure 7 the armature is turned until the tip of the brushes at 1 are just at the edge of one of the commutator segments. Count the number of segments between this point and the tip of the brushes at 2, which should also be at the edge of a segment. From this point the segments are counted to the tip of the brushes at 3, and so on. There must be the same number of segments from 1 to 2 as there are from 2 to 3, or from 3 to 4, or 4 to 1.

It makes no difference how many sets of brushes there are. If there were only

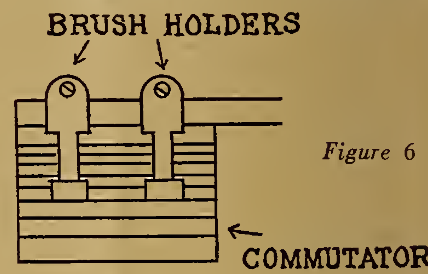

Figure 6

two, we would count from 1 to 3. Number 2 set would not be there. Then count from 3 to 1. The place where the number 4 set is would also be unoccupied. Similarly, if there were six or more brushes, we would count from one to the next, then from that set to the following set, and so on. Any brush that is out of place must be moved to the proper position and then sanded.

It is usually possible to move the entire brush rig with or against the direction of rotation. Sometimes the end casting can be shifted. Often there will be marks showing when this is set in the position for best commutation. If these marks are gone or the brushes are sparking anyway, as a result of having been shifted from the neutral position, they can be returned to the proper position by shifting them until the sparking is at a minimum while the machine is delivering a normal load. *Be sure to lock the device again.*

Armature Troubles

Troubles in the armature are hard for the projectionist to find and often impossible for him to repair. They usually manifest themselves by sparking at the brushes, as previously mentioned. Short circuits reduce the output of the machine or cause it to fail entirely. They can sometimes be found in the commutator or in the wires connected to it. If such is the case, the particle causing

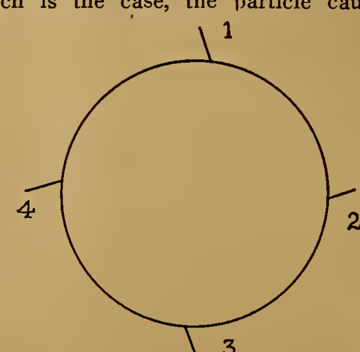

Figure 7

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the "short" in the commutator can be removed or the wires "shorting" can be separated and either taped or some empire cloth put between them and shellacked into place. Shellac should be used even if the wires are taped.

Open circuits become evident by violent sparking and burning of the commutator. Often there will be a ring of fire around the commutator. If this keeps up for any length of time, a flat spot will be burned in the commutator,

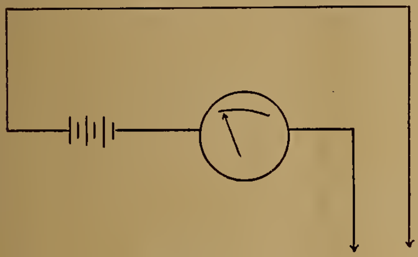

Figure 8

making it necessary to turn it on a lathe. If accessible, it can be repaired easily. If it cannot be reached, the coil can be "shorted" out by soldering a jumper to the two bars to which it is connected, and the machine used until closing.

The two bars connected to the open coil can be found by the use of a battery and an indicating device, such as an ammeter. Lift the brushes from the commutator. Connect the battery and meter as shown in Figure 8. Place the test point on adjacent bars and adjust the current so the meter reads as close to maximum as can be conveniently arranged. This is done because we must find the open coil by the *difference* in the readings, and the greater the reading we start with, the larger will be the differ-

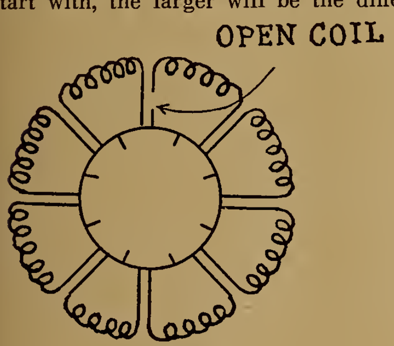

Figure 9

ence when we get to the defective coil. It is best to adjust the current by using more or less battery or by using a meter having a different range, rather than by placing resistance in the test circuit to cut it down. When resistance is put in the test circuit, the difference in the readings will be less.

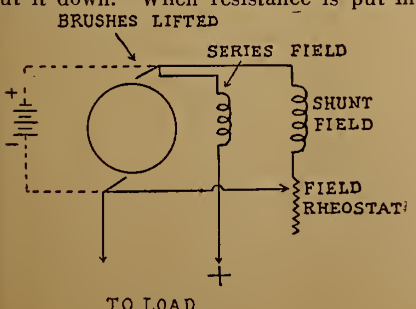

Figure 10

Figure 9 shows how the coils are wired to the commutator. In testing from one bar to the next the current will flow only through the coil connected to those two bars. It cannot flow through the rest of the armature on account of the open coil. However, when we test across the faulty coil the current cannot go through it, but flows through all the other coils. The current will be greatly reduced as a result of the increased resistance. These two bars are now connected by soldering a jumper wire to them—and the show can go on. Don't leave it this way indefinitely; it must be repaired the next day.

A grounded armature may or may not cause trouble. If the system is not

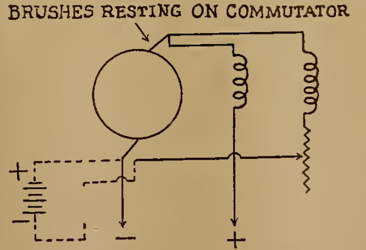

Figure 11

grounded elsewhere, a ground could be present in the armature for months without its presence ever being suspected. If a second ground occurs, it will have the same effect as a "short." If the system is normally grounded and a ground then develops, it also forms a "short." To test for a grounded armature lift the brushes, place one test point on the shaft and the other on the commutator. A reading shows a ground. (It may be in either the commutator or the armature.) In this test a voltmeter must be used, as an ammeter usually would be ruined.

Loss of Magnetism

Loss of residual magnetism is sometimes baffling. Fortunately, it does not occur frequently. It is only necessary to send a current through the field, using an outside source as a battery, or another generator. The writer once used a mercury arc rectifier to remagnetize the field of a generator. The only harm that can be done, as a rule, is to reverse the polarity of the machine. If this happens, send the current through the fields again, but in the opposite direction.

First method: Lift the brushes, then connect the positive of the magnetizing current to the positive brush, and the negative to the negative brush. If it is not known which is which, try it one way, and if the polarity comes up backwards, reverse the connections and shoot it again. Break the circuit very slowly, so as to draw a long spark, causing the current to die away more slowly than it otherwise would. Turning back the field rheostat before opening the circuit helps. If the current is broken too rapidly, the voltage set up by self-induction may be great enough to puncture the insulation of the field coils. *Caution: Do not touch*

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the two wires where the break occurs. You may get a powerful shock.

Second method: The field circuit may be opened at one of the brushes and the magnetizing circuit connected in there. The negative of the outside circuit must be hooked to the positive brush, and the positive wire is hooked to the field coil that was disconnected from the brush. With this method the brushes must remain on the commutator to complete the circuit. In either case the shunt field is the one to use, as it does not require so great a flow of circuit. The external circuit of the generator must be open, otherwise the greater portion of the current might go hopping around through the arc lamps or elsewhere. This also applies to the first method. Figures 10 and 11 show the two methods. In both figures the dotted lines show the temporary outside circuit.

It has been said that someone tried to start a generator with the field rheostat turned clear back. This is often cause enough for lack of current. Of course, turning up the rheostat remedies the difficulty. Some machines will not build up if the external circuit is closed through a fairly low resistance. Be sure load is off the machine before starting.

Only a few words need be added in conclusion. Keep all connections clean and tight. Don't leave loose objects lying around the machine. Blow the dust out occasionally with bellows.

Addenda

Reflections on the foregoing article on motor generators by A. C. Schroeder

MR. SCHROEDER has described in detail how to sand-in brushes, but made no mention of the necessity for carefully removing all sand from the commutator, brushes and brushholders before resuming operation. This is very important to prevent undue wear on brushes and commutator and can be accomplished by carefully wiping the brushes, brushholders and commutator with a clean dry rag after sanding.

Different materials are used in generator brushes and quite different kinds of materials are required for different operating conditions. Low-voltage, heavy-current machines require brushes with very much lower resistance and larger copper content than machines of high voltage and low current.

It is very necessary to use the proper grade of brushes in each machine and projectionists should be instructed to use only those brushes supplied by the manufacturer of the particular machine they are operating. Failure to do this may cause rapid wear of the brushes or commutator, and unsatisfactory commutation may ensue, resulting in sparking and damage to the commutator. Also, brushes of suitable composition contain lubricating material which provides the proper amount of lubrication for the particular combination of brush and commutator being used.

The article covers interestingly how to detect and correct troubles and defects, but I think more stress should be laid on proper care under ordinary operation in order to prevent such troubles from developing. Grit or dirt of any kind should not be allowed to collect on the commutator or brushholders. It will cause wearing of these parts and also if allowed to collect in quantities may cause grounding or short-circuit, destroying the insulation.

Lubrication is very important. Generally, projectionists use too much oil, rather than not enough. It is important, of course, to provide sufficient lubrication to prevent wearing out of the bearings, but most projectionists put so much oil that it leaks out onto the commutator or brushes. The most common cause of the failure of motors and generators is oil on the brushes, causing sparking between commutator and brushes. Also, oil on the commutator or brushes collects dirt, sometimes causing short-circuits. Even when care is used not to apply excess oil, the brushes and commutator should be frequently inspected and wiped clean with a clean, dry rag.—WILLIAM H. HAINES.

From I. P., March, 1933

★ Schroeder Defends Brush-Fitting Procedure ★

MY attention has been directed to certain comments in the course of which Mr. F. H. Richardson, answering an inquiry from Mr. J. L. Schrock of Missouri, criticizes my remarks on fitting brushes. Evidently Mr. Richardson does not like my particular method. He says that the method is O.K. theoretically (which means it can't be so very wrong) but he implies that it just won't work out practically.

Mr. Richardson's remarks are very inconsistent. He thinks that projectionists will not go to the trouble of raising the brush before pulling the sandpaper back; but in the next breath he suggests that the brush be held with a screwdriver by "an assistant" while the projectionist pulls the paper back and forth. Further along in his comments he says that after sanding the brush and running it in for a half-hour, it should be removed two or three times and the shiny spots sanded off each time.

Does Mr. Richardson think that a man who will not raise a brush while sanding it will go to the trouble of pulling the brush out two or three times and very carefully sand off the shiny spots until the fit is perfect? Or maybe he thinks that his method is not so much work as raising the brush for the return of the paper. He admits, however, that pulling the paper in both directions, as *he* suggests, might not be the best way. He says: "However, if you want something a bit better, have an assistant hold a screwdriver against the brush to prevent it from tilting."

Now, it's all right with me, and one may take his choice: either pull the sandpaper in one direction, as I described it, or hold the brush with a screwdriver, as Mr. Richardson suggests, and pull the paper both ways. On some machines, however, the construction is such that the brush cannot be kept from tilting by using the screwdriver method, and, in fact, it is very difficult to utilize this method on any machine.

There is one statement in Mr. Richardson's comment from which I most emphati-

From I. P., September, 1933

cally dissent. He says that certain advice (on projection) is of little value because so few men will heed it. This thought, carried to its logical conclusion, would mean inefficient projectionists and generally poor projection—a clear case of "Oh, what's the use?"

Mr. Richardson must admit that at least one man has benefitted by my article, and that man is his correspondent, Mr. Schrock. The latter says that he has fitted brushes by pulling the paper both ways for a long time—maybe for years—and he apparently has not given the matter much thought. *But*, and this is the important point, he read my article and *started to think about the subject.* "Maybe Schroeder is right and I am wrong," he might have thought. In any event, Mr. Schrock went to the trouble to write a letter to Mr. Richardson and ask his views on the matter—an act which definitely bespeaks keen interest.

The chances are that Mr. Schrock now will go to a bit more bother in fitting his brushes. He may even go to the trouble of following Mr. Richardson's advice and pull the brush out two or three times in order to sand the high spots. At least he knows more about the subject than he did before he read my notes, even though they appear to be "too finely spun" to suit Mr. Richardson.—A. C. SCHROEDER.

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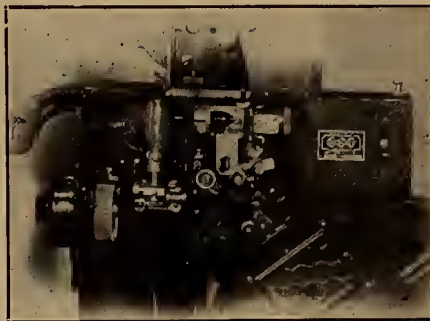

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LIGHT AND LENSES

(*Continued from page* 15)

boundary of a wave-front coming from one corner of the screen; it comes to a point at the corner of a frame of film. Now, to get the same amount of illumination at this point as at the center, this wave-front should continue to advance along the same line. See where it lands. In order to furnish that illumination a 12- or 14-inch condenser would be required. A condensing lens of that diameter of the proper focal length to keep the arc within 4 inches of the lens (which must be done to get proper efficiency) would be so thick that spherical aberration would make impossible its use.

Reflector Arcs

Now, perhaps, you get a clearer idea as to why the reflector arc is so much more efficient than the straight arc. In handling wave-fronts the mirror acts just like a lens, except that the light passes through but a very thin thickness of glass. There is no difficulty experienced in making a mirror of 6, 8, 12, or 14 inches in diameter. The trend toward reflector arcs is thus inevitable.

First we had the 20-ampere lamps, then the 30-, 60-, and 70-amperes lamps. The next development will be 90- and 100-ampere reflector arcs.

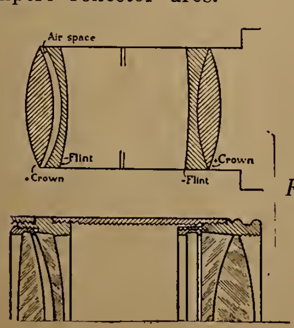

Figure 21

The question of whether to use a 6½ or 7½ focus, or any other focal length plano convex 4½-inch diameter condenser, has become only of academic interest, due to the introduction of the reflector arc, and is no longer of interest to us. Previously it was almost wholly a matter of "cut and try." It could have been reduced to a certainty, but it never was. All that I have ever read approached the topic from the wrong angle, the theories upon which these expositions were built were fundamentally wrong, and the writers thereof endeavored to find an explanation for what was found in practice to be correct, instead of trying to determine theoretically what would be best and then attempting to reduce that determination to practice.

Bausch and Lomb undoubtedly dug into the subject from a scientific angle and, instead of trying to determine which of the popular combinations was best, found that none of them was even fair. They then began developing their Cinephor series of condensers.

Let us get back to the projection lens for a moment.

The Petzval Type Lens

In 1840 Petzval brought out a portrait lens which worked at the remarkable diaphragm (for that period) of f/3.5, when at that time f/60 was considered good and when, in fact, portraits were very difficult to take because the subject could not sit still long enough to allow for sufficient exposure. I can't go too deeply into apertures just now, but suffice it to say that for a lens of 6-inch E.F. the free opening of the Petzval would be 1.7 inches, and of the f/60 it would be .1, so that the Petzval would have 17 times the diameter and would pass about 290 times as much light.

Owing to the large relative aperture, the Petzval was immediately adapted for lantern work. Figure 21 is a sketch of a Petzval lens taken from a book published about 40 years ago. This lens consisted of a cemented front combination of flint and crown glass and a back combination of flint and crown separated by an air space, the combinations being separated by a distance depending upon the focal length.

Let us look back to the state of science and industry in 1840. The arc lamp had not been invented; automobiles, telephones, and phonographs were missing. Railroads were just being developed, and the electrical industry as a whole was not even dreamed of. In thinking of the great development in other lines one might expect the projection lens to develop apace. Let us see.

The lower half of Figure 21 was taken from a circular received from an optical company[1] describing their newest development in projection lenses[2]. Ninety years have not changed the fundamental

design of projection lenses one iota. But, while the principle of the lens has not been changed within this time, there has been great development in the *execution of that design.* Hartung[3], after describing the Petzval as an extremely good projection lens says: "The Petzval objective must be very carefully constructed if it is actually to show its whole efficiency. Unfortunately, this cannot be said of most of the so-called projection lenses made on the Petzval formula."

So that while both sections of Figure 21 look identical, the newer lens, and all other lenses built on this formula, are good or bad not according to the design but according to the care and skill exercised in the *execution of the design.*

In this particular lens[2] it seems to me that the great advantage for projectionists lies in the fact that it is so constructed that if all the glasses and all the rings are removed and scattered about, they cannot be put back together in any way but the right way.

The passing of the straight arc and the accompanying introduction of the Cinephor condensers have narrowed considerably the field of individual preference for projection lenses. The method generally used in the past in introducing newly developed projection lenses has been to try one out in a projector, with practically no consideration being given to the fact that the old lens is dirty and the new one clean. Naturally the new lens shows up well, by comparison, and sometimes the house buys it. I hope that this is no longer the practice here (Cleveland), as an actual screen test is the only sensible method in which to determine the value of any projection lens.

It is very important that we understand the "language" of lenses, in order that we may take advantage of the information on lenses which is disseminated through various channels. Much valuable information escapes that man who is not fully conversant with the "language" of lenses.

The 'Working Diameter'

One point often referred to is the "free aperture," or "working diameter" of a lens. Lens manufacturers endeavor to increase this aperture as much as possible. It might seem that in order to get a larger aperture all that is necessary is to make the glasses of larger diameter. While this is so, it must be remembered that from the standpoint of the manufacturer every 1/16-inch added to the diameter of the lens very greatly increases the difficulty of securing a clear, sharply-focused picture over the entire screen.

The advantage of the larger aperture is that it permits the passage through it of more light. The photographers among you understand the subject; but from experience I know that sometimes you do not correctly apply your photographic experience to a consideration of projection lenses.

The speed of a camera lens is commonly rated as a fraction or ratio—the focal length divided by the so-called f-number, the quotient being the working diameter of the lens or of the diaphragm, if there is one. The smaller the opening in the diaphragm (that is, the larger the f-number) the clearer the picture and the greater the depth of focus, but the longer the time of exposure required.

The larger the opening (that is, the smaller the f-number) the more difficult it is to build a lens that will give a clear picture all over, but the less time required for exposure. Photographic lens have now been developed rated at f/4.5, f/3.5, f/2, f/1.7 and even less, according to some manufacturers' claims. When we pass f/1.5, however, we may be pardoned for having a doubt as to the accuracy of such claims.

As noted previously, the projection lens started out on the Petzval formula with a claim of f/3.5 for portrait work. Most manufacturers of projection lenses did not claim better than f/4, however, and this size came to be known as a "quarter-size lens." It is possible that some of you have not known where that term originated. An f/4, five-inch focus lens would be 1¼ inches in diameter,

[1]Kollmorgen Optical Co.
[2]"Solex."
[3]"Optics for Photographers."

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which you will remember to be about the size of the old quarter-size lens.

Half-size projection lenses began to come in, that is, lenses rated at f/2, but in this case the f/2 was theory only, for it is only within the last year or so that even an f/2.5 lens of good quality has been put on the market; and f/2 is still in the distance. Lenses have now advanced in development beyond the projector, for in many cases better lenses could be provided if there were room for them in the projectors. This deficiency will be compensated for shortly, we hope.

In Table A is a representation of the dimensions of the various series of Cinephor lenses that are available (when this article was written—Ed.) showing the free aperture and how it works out on the basis of the f-number. The Cinephor series is used because it is the only one on which I have aperture measurements.

You will note the steady progression from f/3.5 to f/3, f/2.4 and now f/2.3 for the Super-Cinephor. I have no information as to the construction of the latter type, rated at f/2.3, but I have no doubt that it is a modification of the

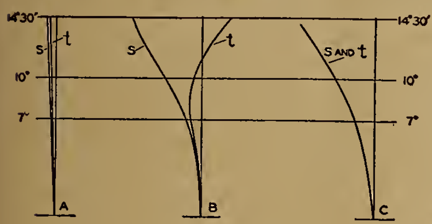

Figure 22

Petzval formula which permits of correction for spherical and chromatic aberration and for astigmatism.

We touched briefly on these corrections previously. Referring to the illustration (Fig. 16) you will remember that our problem is to get *s* and *t* to focus together to correct for astigmatism, and also to get the two of them to lay back flat upon the screen to get flatness of field.

In Figure 22 are the curves representing the results of the corrections. In curve C, *s* and *t* stay close together, but the field is badly curved. Curve B shows an earlier Cinephor in which *s* and *t* are kept close together up to 7° with a fairly flat field. Anastigmats, or lenses which are corrected for astigmatism, are common enough in photography, but on account of the very large relative aperture of the projection lens it is extremely difficult to correct for both astigmatism and curvature of field without losing definition at the center of the screen because of spherical aberration.

Curve A illustrates the claims for the new Super-Cinephor, showing *s* and *t* together and with both curves being almost vertical, thus indicating an unusually flat field. Other curves of the manufacturer support the claim that, in addition, this lens is also corrected for spherical aberration, so that it is just as clear in the center as the other lenses which are not corrected for astigmatism.

You will remember that previously we found that a 7° angle represents a lens corrected for the present standard film, and that the 14° angle represents the necessary correction for wide film.

The matter of aperture enters into one other question which has been frequently asked in the last year or so—that is, whether it is practical to change the focal length of a projection lens by varying the separation of the combinations. The answer is "Yes, within certain limits." In fact, the focal length of any projection lens depends directly upon the separation of the elements according to this formula:

$$F = \frac{f_1 \quad f_2}{f_1 + f_2 - e}$$

You will note that as the distance between the elements increases the denominator of the fraction gets smaller and the focal length increases. As *e* decreases the focal length of the combination will decrease.

There is one limiting factor, and, within the limits of the use now made of variable focal length of objectives (that of changing from a .906 frame to an .825 frame) it is not serious. As the elements are drawn apart the effective, or free, aperture of the lens combination is made smaller and less light will pass through.

I think that this can be shown by referring again to Figure 20. A line is used here to represent the lens; but suppose that line represented only the back element next to the film. You can readily see that in placing the second element, the closer it is placed to the first element, the more of the light from the edge of the picture will be picked up by the second element. Separating these elements allows more of the light from the edge of the film to strike the barrel, the effect on the effective aperture being the same as if the elements had been left close together and a diaphragm introduced.

Table A (Based on B. & L. Cinephor Lenses)

Type	Speed	Focus		Estimated Aperture	Actual Aperture
Series O	f/3.5	5"	5/3.5 gives	1 3/7"	1 13/32"
Series I	f/3	5"	5/3 "	1 2/3"	1 23/32"
Series II	f/2.4	5"	5/2.4 "	2 1/12"	2 3/32"
Super Cinephor	f/2.3	5"	5/2.3 "	2 4/23"	2 3/16"


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Review Number

Volume 8
May, 1935
Number 5

Leading Articles in this Issue

Foreword ... 3

Frontispiece ... 4

Testing Electrical Circuits ... 5

Projection Effect Work With Ultra-Violet Light ... 8

Does the H. I. Arc Tail Flame Contribute To Screen Light? ... 9

Repair Work by Projectionists ... 10

Halation Overcome by Gray-Back Film ... 10

The Decibel and Its Uses ... 11

Strike Now—For the Future ... 12

Light and Lenses ... 13

Screen Image Sizes (Table) ... 16

Film Stock: Types and Uses ... 17

Distortion in Motion Pictures ... 18

Maintaining Motor Generators ... 20

Relation of Electron Flow to Current Flow ... 25

'Ground' Testing Made Easy ... 26

Arc Light Factor Calculation ... 26

Color Systems Must Recognize Projection Requisites ... 29

Factors Affecting the Useful Life of Screens ... 30

The Third Dimension in Motion Pictures ... 34

H. I. Arc Alignment ... 35

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Theatre Management, 1935 Style

WE PUBLISHED recently a story originating in San Francisco relating to a projectionist who, having "misplaced the sixth and last reel" of a feature, let his "bungling fingers" pick up an old "dust-covered slide" and desperately flashed it upon the screen. The slide read: "And So This Story Ends . . . And We Bid You All Good Night." The story then related that this slide failed to satisfy the audience suspense and failed, also, to hold the projectionist's job. So far so good.

That which was merely humorous, however, becomes positively hilarious in the light of the following information supplied by W. G. Woods, Secretary of S. F. Local 162, as follows:

"I was particularly interested in this story because it isn't merely a gag; it really happened—with one trifling (?) exception. The manager of the theatre indicated makes a *habit* of this trick, and instead of the slide being an 'old dusty one,' it is kept shiny and resplendent and quite handy for such occasions—that is, whenever the show runs overtime.

"In fact, this slide is used *regularly* to stave off a half hour overtime payment, which makes your story even better than you suspected it was. Incidentally, this same manager has been known to cut one or two reels of a 7-reel feature when the show 'threatens' to run overtime, *in addition*, of course, to using the aforementioned and now celebrated slide.

"This is really a good story anyway you present it; but I am forced to supply an anti-climatic punch by challenging the statement that the projectionist is still looking for a job. He most emphatically *is not*, because his most important job, even to this date in the *same theatre* is to get out on time."

The craft at large is indebted to Mr. Woods for a most delectable addition to the literature of the projection art.

★ From I.P., August, 1934.

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STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING SYSTEMS —THE DEVELOPMENT OF THE MOVIE PROJECTOR—NEWS AND VIEWS—TECHNICAL HINTS—CRAFT ACTIVITIES

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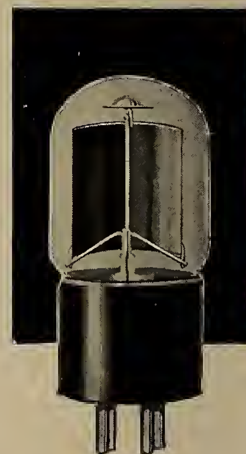

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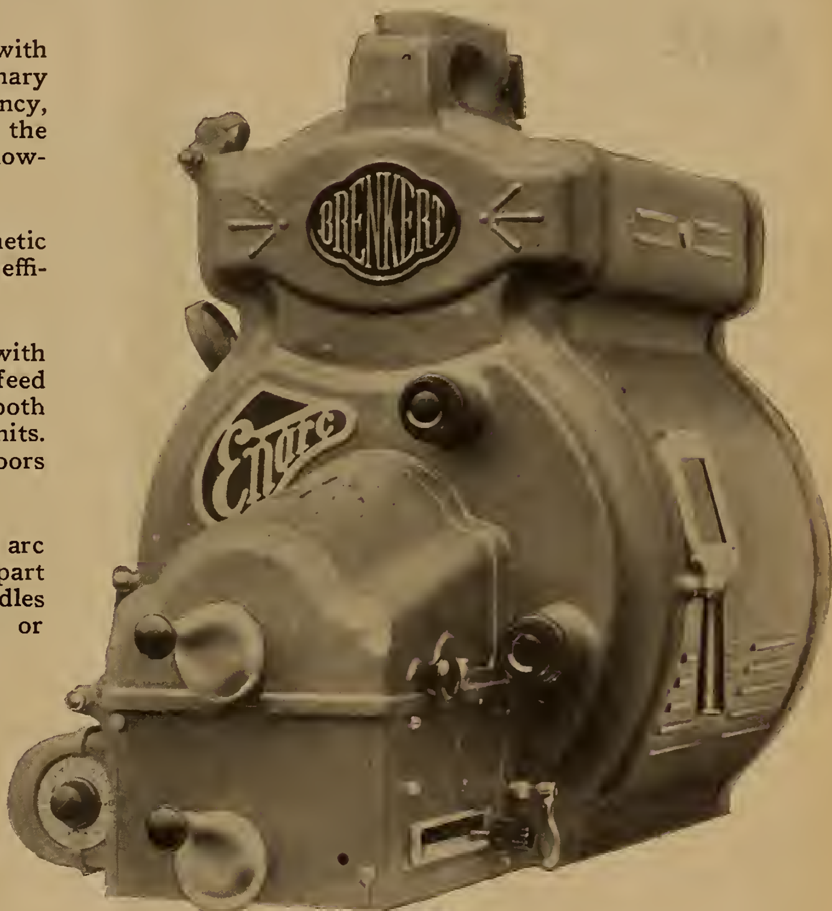

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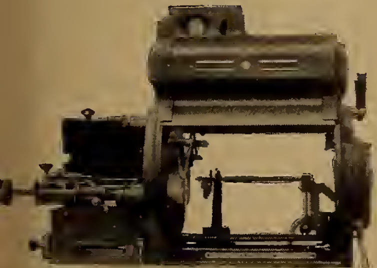

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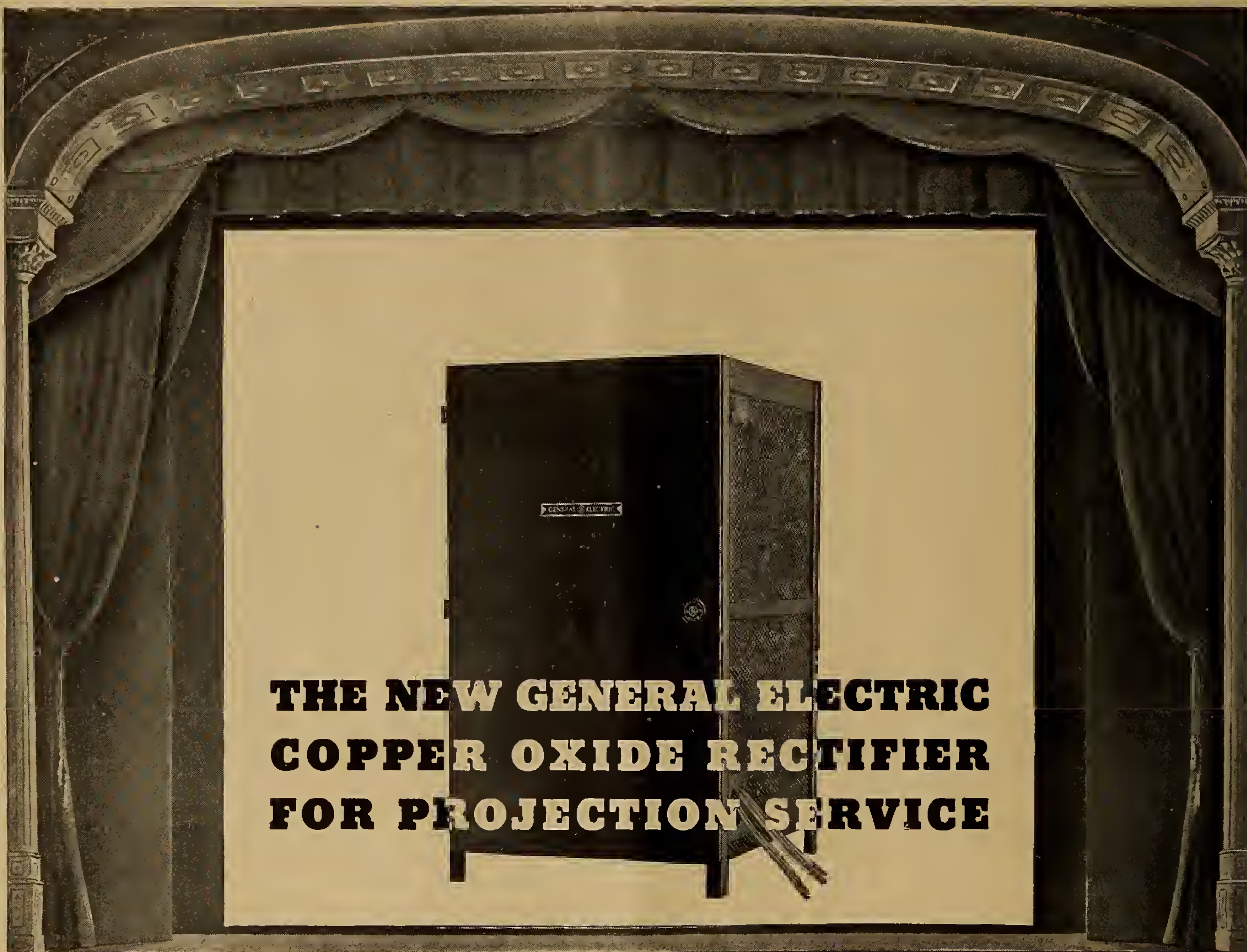

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Volume 8 JUNE 1935 *No. 6*

Index and Monthly Chat 5

Step-by-Step Analysis of Sound Reproducing Equipment, XI 7
AARON NADELL

Development of the Motion Picture Projector 10
THOMAS ARMAT

The Technicolor Process of 3-Color Cinematography 12
J. A. BALL

Color Consciousness 15
NATALIE KALMUS

N. Y. Press Comment on 'Becky Sharp', First All-Color Film 16

Academy's Studio-Theatre Coordination Program 17

Independent Dealers' Convention 18

I.A. Levies General 2% Assessment to Raise Million-Dollar Defense Fund 19

Line Voltage Regulation 20
LEROY CHADBOURNE

Smothering Opposition via the Educational Route 23
JAMES J. FINN

News Notes
Technical Hints
Miscellaneous Items

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420

MONTHLY CHAT

COLOR-CONSCIOUS is the phrase that most accurately describes the focal point of interest within the industry just now, what with "Becky Sharp," first all-color feature film, piling up midwinter grosses despite weather unfavorable to show business. Whether the aforementioned respectable grosses indicate a temporary interest or not can not be known definitely until a few all-color features have been released.

HOWEVER all this may be, within these pages this month appear data by Technicolor representatives which will enable projectionists to know just what the process is all about. Our own notion of what color means to the industry will be found on the editorial page. Opinions to the contrary will be welcome, of course.

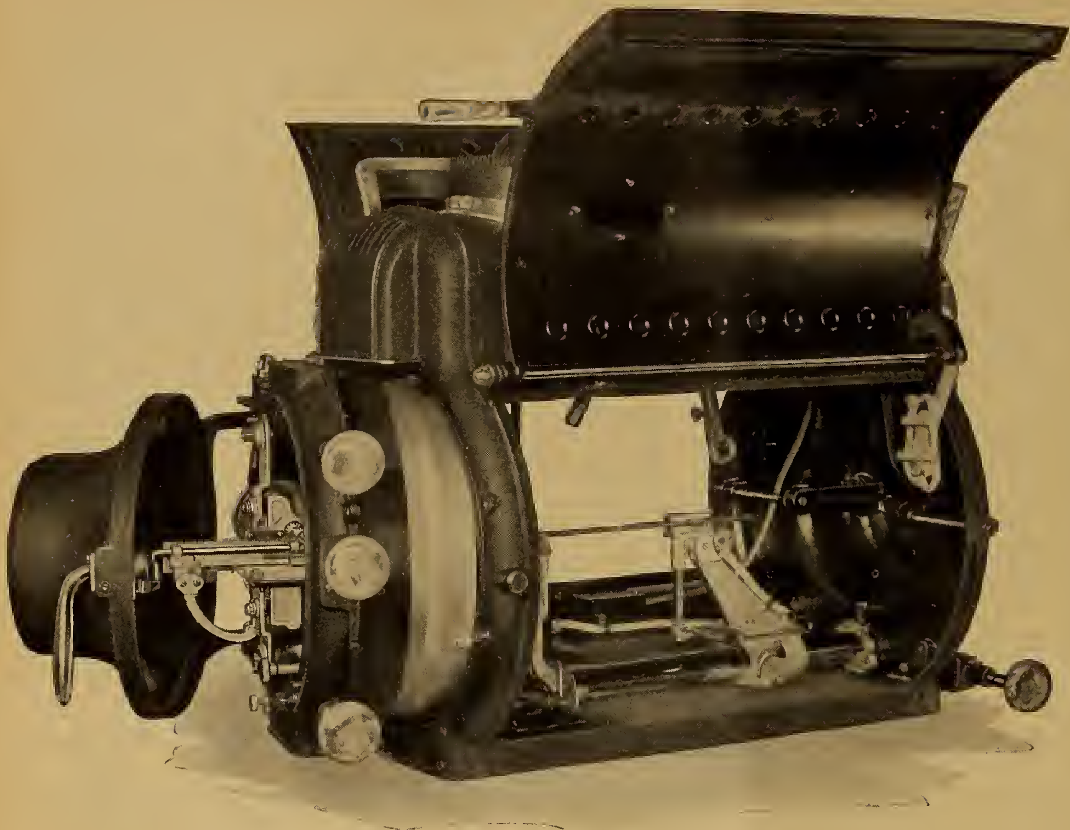
ONE blessing of color film production is the renewed interest by studio people in proper set lighting. Always firm believers in "hard lighting," by which is meant carbon arc lighting, we welcome this re-examination into an almost forgotten art. With probably a half dozen exceptions, all motion pictures since 1928, when sound pictures burst through, have exhibited lighting that was brutal. Projection screens the world over reflected only the pasty gray of "soft lighting," and no amount of amperage made any difference. There's hope for the future of intelligent studio lighting, now that arcs have been effectively silenced.

WE repeat our annual health warning: Warm weather is here. Don't be cooped up in a stuffy fume-ridden projection room all day, and then head for a couch, a beer parlor, or a hammock. Get out in the open; take a walk in the park, if only for an hour. And if you do make a foray into the country, paste in your hat a copy of the summer dont's printed elsewhere herein.

CLOSE inspection of a number of new-type Suprex arcs operating in the field occasions some doubt as to the complete reliability of figures published to date relative to costs, carbon burning times and general operating characteristics of this new development. It might not be amiss to suggest a re-examination of this arc by some responsible technical body, to the ultimate benefit of both the manufacturers and the theatre field.

There can be no question but that the Suprex carbon arc delivers great gobs of beautiful light, but there still remain a few lingering doubts as to its operating characteristics—and costs.

NRA having done practically nothing even with government authority and prestige on its side, this business now blabs about "voluntary" codes. It is to laugh.



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INTERNATIONAL PROJECTIONIST

VOLUME VIII NUMBER 6

JUNE 1935

Step-By-Step Analysis of Sound Reproducing Equipment

By AARON NADELL

XI. P. E. C. Amplifier and Its Switching Controls

FIGURE 1 represents the electrical circuits of one type of Western Electric Universal Base. The equipment consists of four component parts, as follows: 1. Upper left of the drawing, within the large dot-and-dash rectangle, a 49-A amplifier together with its photoelectric cell. 2. Upper right of the drawing, within the tall dot-and-dash rectangle, an attenuator or volume matching panel, designated as the 701-A Apparatus Unit.

Also: 3. Lower left of the drawing, inside the long dot-and-dash rectangle, a switching panel, the 700-A Apparatus Unit; and 4. Grouped at the extreme lower right, the disc reproducing circuit, including (inside the large rectangle of dashes) the 7A equalizer that is shown in detail in Figure 2.

External speech and power connections to Figure 1 are made at the row of binding posts shown along the top of the 700-A Apparatus Unit, or switching panel, in the lower left of the drawing. Following these binding posts from left to right:

The extreme left-hand terminal, marked "Gnd." serves for connection to a similar terminal within the 49 amplifier and to the negative leg of the exciter lamp circuit. The next, marked "+12 V", likewise connects to a corresponding post in the amplifier, and also to the positive exciter lamp lead. The third terminal from the left, marked "Gnd." and connected by a jumper to the extreme left-hand terminal that is also marked "Gnd.," serves as the negative terminal of the external 90-volt and 12-volt power supplies. The positive terminals for those supply lines are the fourth and fifth posts.

The sixth and seventh terminals, marked "Out." supply speech power from Figure 1 to the external fader and thence to the system amplifier. The two binding posts at the extreme right, marked "Disc In," receive speech current generated in the disc reproducer and pass it on to the lower resistance pad in the 701-A Apparatus Unit, from which that current returns to the two "Out" terminals and thence proceeds to the fader.

It should prove convenient to study and dispose of this disc circuit before attempting to trace the more intricate arrangements of the film reproducer.

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Figure 1 of this article appears on the next page.

Disc Circuits of Figure 1

The disc pick-up proper is seen within the small rectangle of dashes at the extreme right of the drawing. It is labelled "104-A Reproducer." When the needle of this instrument is vibrated by irregularities of a sound groove in a disc record, alternating current corresponding in frequency and strength to that vibration is generated in the coil of the reproducer, and flows through the two

M1D cords to thus complete its circuit.

At the 29-A connection block the M1D cords that extend from the reproducer, and are usually removed with it when a reproducer is changed, connect to the permanent wiring of the Universal Base. Thence the circuit continues through another pair of cords to the 11-B connection block, at which point the 7A equalizer is shunted across the line.

The 7A Equalizer

In Figure 1 connections to this equalizer are made at its terminals 2 and 4. This is a medium setting. Figure 2 shows that one side of the line must always be connected to terminal 4, but the other side may be wired optionally to posts 1, 2 or 3. Connecting to posts 4 and 3 results in the maximum high-frequency attenuation. In most theatres satisfactory reduction of needle noise, without excessive high-frequency loss, is obtained by using the 4-2 setting of Figure 1.

Disc Switching Circuit

From its point of junction with the 7A equalizer, the 11-B connector, the disc circuit continues through a flexible conduit to the two right-hand binding posts of the switching panel. From the right-hand post of this pair the circuit is jumped to No. 2 output terminal. That side of the disc line is therefore always connected to the fader, and is not broken at the switching panel. The other side of the disc line runs from the left-hand disc input post down, right a bit, and down to the "Disc" point of a switch. It is this side of the line that is opened by the switching arrangements.

In the drawing, the blade of the switch (the arrowhead) is set at "Off." Assuming it to be set at "Disc," the circuit may be traced through the arrowhead, right along the blue-red wire, up, left and up to terminal No. 3 of the 701-A attenuator unit.

Disc Attenuator Circuit

The arrangement of this attenuator is designed to maintain constant impedance in the disc speech output line despite changes of the setting, which are made for the purpose of matching the volume from the two projectors. It consists of three resistors, two in series with the circuit and one in parallel, the whole so constructed that whenever the series resistance is reduced (increasing volume), a proportionate resistance is shunted in parallel to keep the impedance match constant.

The drawing does not represent the physical appearance of the unit, in which three resistance windings are placed side by side. Each is provided with contact taps. A small brass jumper, held by three machine screws, can be moved up or down from one set of taps to another to change the action of the attenuator. When it is moved upward it has the effect of drawing the two arrowheads of the lower horizontal resistors further apart, thereby decreasing the series resistance, while at the same time it draws the arrowhead of the lower vertical resistor downward, adding to the shunt resistance. When the two arrowheads of the horizontal resistors are drawn completely apart, eliminating all series resistance, the third arrowhead has been drawn downward past the bottom of the shunt resistor, open-circuiting the shunt and leaving the 500-ohm output of the 7A equalizer looking directly into the 500-ohm input of the fader.

Now to trace this circuit in detail: from the *left*-hand disc input terminal down through the switch; from the switch arrowhead up through the blue-red wire to terminal No. 3 of the attenuator panel; thence through the lower left-hand horizontal resistor, through the arrowheads, through the lower right-hand horizontal resistor and thus to terminal No. 4 of the attenuator; thence through the blue wire, down, left and down to output terminal No. 1; through the external load and back in at output terminal No. 2; thence across the jumper to the other, or *right*-hand, disc input terminal.

The two lower horizontal resistors are, therefore, in series with output terminal No. 1. The lower vertical resistor branches from them through the arrowhead connectors and bridges across the line to output terminal No. 2.

A similar arrangement is seen at the top of the 701-A Apparatus Unit, serving the same purpose with respect to the speech output of the photo-cell amplifier. One difference between the two circuits, however, is that the upper attenuator has 10 settings, covering 30 db, while the lower attenuator just traced has only 3 settings, covering 9 db. Obviously, many factors can vary the film volume and cause it to become either greater

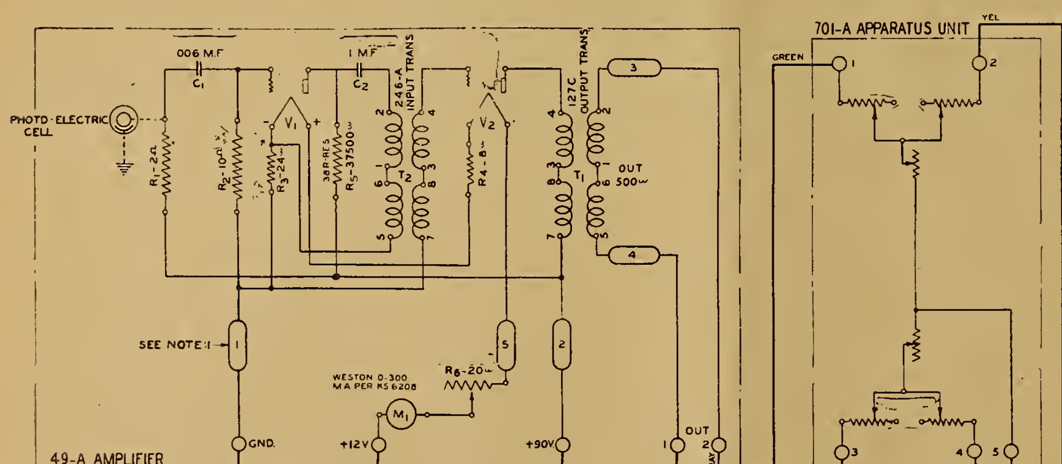
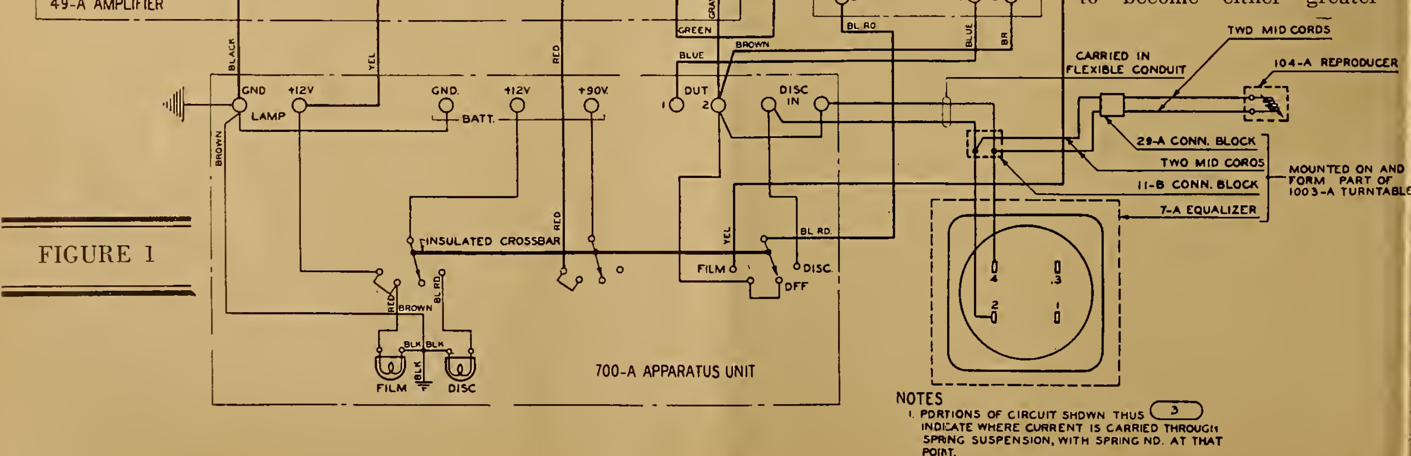



FIGURE 1

or less than that drawn from the other projector, while the disc output is little subject to variation. Another difference is that the film output, as will be seen, completes its circuit through the lower as well as the upper attenuator.

The arrowhead that closes contact with the line leading from the left-hand disc input terminal is moved by an insulated crossbar, so designated on the drawing and represented by a heavy horizontal line. This bar, of course, carries no current. It serves to move two other switch blades, shown to the left of the one we have just considered. All three switches move in unison by virtue of the action of this bar.

When the right-hand switch is set at disc, the center switch-blade touches a dead contact, and that switch does nothing. The left-hand switch arrowhead, however, closes the circuit to a blue-red wire that runs to the disc signal lamp.

The signal lamp circuit may be traced as follows: from the 12-volt positive input, which is the fourth terminal from the left of the 700-A Apparatus Unit; down, left and down to the switch arrowhead; through the blue-red terminal of the switch to the disc signal lamp; through the lamp filament to the black wire and the ground connection; up, left and up through the brown wire to the extreme left-hand terminal marked "Gnd.," and thence right through the jumper to the third terminal from the left, similarly marked, which carries the negative lead of the external 12-volt source. The purpose of the arrangement is to indicate by a signal bulls-eye when the switch is set for disc reproduction.

Switching Circuits of Figure 1

The four positions of the switches operated by the insulated crossbar may now be traced in detail.

When the insulated crossbar pushes the three arrowheads to the extreme right. the function of each switch is:

Right-hand switch: closes disc speech circuit.

Center switch: does nothing.

Left-hand switch: closes disc signal lamp circuit.

Now, if the crossbar moves the arrowheads one point to the left, the action of each switch is:

Right-hand switch: Off; shorts attenuator terminals 3 and 5.

Center switch: does nothing.

Left-hand switch: does nothing.

Again supposing the crossbar to move the blades one point leftward, the functions of the three switches become:

Right-hand switch: Off, as before.

Center switch: Closes 90-volt circuit to amplifier and photo-cell.

Left-hand switch: Closes 12-volt circuit to amplifier and exciting lamp; lights "film" signal lamp.

If the switch is carelessly left in this position the film signal lamp will glow, but no sound will be heard because the

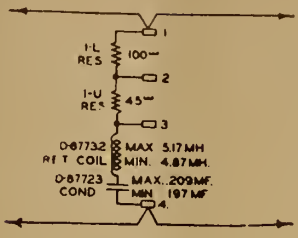


FIGURE 2

film amplifier output circuit is still open at the right-hand switch.

Moving the insulated crossbar to close the last contacts to the left results in:

Right-hand switch: bridges attenuator terminals 2 and 3, closing film amplifier output circuit.

Center switch: same as previous position.

Left-hand switch: same as previous position.

Filament Circuits of Figure 1

Assuming these switches to be set for film operation, namely, with the three arrowhead blades making contact with the three extreme left-hand switch-points, the 12-volt circuits of this drawing may be traced from the positive input, which is the fourth terminal from the left of the 700-A switching unit. Thence down, left and down to the left-hand switch arrowhead. At the left-hand contact of the switch the circuit branches: one leg runs through the film signal lamp and thence right to the ground connection, from which the brown wire leads up, left and up to the extreme left binding post, which is jumped across to the negative power terminal.

Returning to the switch, another leg of the circuit can be followed from the extreme left-hand switch-point to the second terminal from the left, where another division takes place. An external connection leaves this binding post to supply the exciter lamp, the negative return running through the extreme left-hand terminal and the jumper.

The third circuit can be traced from this point of division, the second binding post from the left, right and upward to the positive 12-volt binding post of the 49-A amplifier. Thence up and right through the milliammeter, through filament rheostat R-6 and suspension spring No. 5 to the filament of V-2. Through that filament and down through resistor R-4; thence down, left and up to the filament of V-1. Through this, down through R-3, down, left and down through suspension spring No. 1 to the ground terminal of the amplifier; thence through the black wire to the ground terminal of the switching panel and through the jumper to the negative side of the source.

The positive power lead of the plate supply of Figure 1 is attached to the terminal marked "+90V." The negative, in common with the negative 12-volt supply, goes to the third terminal from the left, marked "Gnd." The positive line may be traced from the 90-volt input down to the arrowhead blade of the center switch, through the left-hand point of that switch and up the red wire to the 90-volt input of the 49-A amplifier, and thence upward through suspension spring No. 2. At the top of that spring the line branches. One leg continues upward through the primary of transformer T-1 to the plate of V-2. Thence through the vacuum to the filament of V-2. From that filament to the filament of V-1, thence to the extreme left-hand terminal of the switching panel and through the jumper to the negative side of the source.

Returning to the upper end of suspension spring No. 2, another branch of the plate circuit can be traced leftward to a point directly under R-5 resistor, where the line again divides. One branch runs upward to R-5, through that resistor to the plate of V-1, across the vacuum to filament of V-1, and thence through R-3 to ground and the negative side of the line.

From the point of division just below R-5 a third leg runs leftward, up through R-1, and left through the dotted line to the anode of the photo-cell. Across the gas of the cell to cathode and thence to ground. In at ground left-hand terminal of the switching panel and through the jumper to negative.

The grid bias of V-1 equals the voltage drop across one-half of its filament plus the voltage drop in R-3. The bias of V-2 is the drop across one-half its filament, plus the drop in R-4, plus all the drop in the filament of V-1, plus the drop in R-3. The current of this circuit is 250 milliamperes, and the drop across each filament is one volt. R-6 may also be adjusted for a filament current of 300 mils, which will result in a corresponding modification of the grid bias.

Speech Circuits of 49A

The a.c. speech component of the photo-cell circuit arises within the cell, in consequence of the variations in illumination to which it is subjected. The P. E. C. may thus be thought of as an a.c. generator. Condenser C-1 and resistor R-2 are connected directly across this generator and serve as a load for its a.c. output. The generator circuit is: from the upper end of R-1 through the gas of the cell to ground. The load circuit is: from the upper end of R-1 through C-1 and R-2 to ground.

The grid and filament of V-1 constitute a capacitance connected in parallel to R-2. This is a standard resistance-capacity coupling, as we have traced it in many amplifiers in the course of this series of articles. However, in this case it is not used to couple the grid of one tube to the plate of the tube preceding, but to couple the grid of a tube to the plate of a photo-cell.

The plate a.c. component of V-1 arises in the vacuum of that tube, in

consequence of the action of its grid. If the tube is thought of as an a.c. generator, its circuit is: from the top of R-5 through plate, vacuum and filament to the top of R-3. The a.c. load circuit runs from the top of R-5 through C-2 condenser and the primary of R-2 transformer, to the top of R-3.

The upper end of T-2 secondary connects directly to the grid of V-2, but in order to take advantage of the grid bias arrangements already described, the lower end of that coil must connect to the filament of V-2 at the negative side of R-3. This connection runs from terminal 7 of T-2 secondary down, left and up to the lower end of R-3. The alternating speech potential induced in the secondary of T-2 is thus placed in series with the grid bias derived, as previously explained, from the voltage drop across R-3, V-1 filament, and R-4.

T-1 primary is connected in series with the plate of V-2. Speech fluctuations in the plate current of that tube generate a corresponding a.c. in the secondary of T-1. That secondary is wired, through suspension springs 3 and 4, to the output terminals in the lower right-hand corner of the amplifier.

Film Output Circuit

The film output circuit through the attenuator panel is similar to the disc output circuit already traced, but not identical with it. In each instance, however, the attenuator is arranged to preserve satisfactory impedance match regardless of changes in its setting.

The circuit may be traced from amplifier output terminal No. 1 through the green wire to attenuator terminal No. 1. Thence through the two upper horizontal resistors to attenuator terminal No. 2. Thence through the yellow wire right, down, right and down to the "Film" or left-hand point of the right-hand switch in the 700-A Apparatus Unit. Thence through the switch arrow and the blue-red wire right, up, left and up to attenuator terminal No. 3. Thence through the two lower horizontal resistors to attenuator terminal No. 4. Thence along the blue wire down, left and down to output terminal No. 1 of the switching unit.

Output terminal No. 2 of the switching unit is connected directly, by the gray wire, to No. 2. output terminal of the amplifier.

The four horizontal resistors, as we have just seen, are in series with each other and with the No. 1 output terminals. From them, by means of the arrowheads, the two vertical resistors branch off and bridge across the line through attenuator terminal No. 5 to output terminals No. 2.

From output terminals 1 and 2 of the switching unit, the speech circuit, as said before, runs to the external fader and thence to the system amplifier.

Development of the Motion Picture Projector

By THOMAS ARMAT

Nine out of ten projectionists, if asked who "invented" or developed the motion picture projector, likely would reply: "Thomas A. Edison." But he didn't; nor did he believe it possible to develop such a mechanism until he actually witnessed a demonstration. This and many other interesting points are included in the appended contribution by T. Armat, to whom is due the major share of credit for the development of a projector the basic features of which remain unchanged to this day. The Historical Committee of the S. M. P. E. deserves the thanks of the industry for this, to us at least, absorbingly interesting contribution to the literature of the art.—Editor.

IT is difficult to trace to its beginning and fix a date for the conception of an idea that leads to an invention. Of the interesting impressions of my childhood, the one made by the toy known as the Zoetrope was among the most outstanding. The idea that its principles might be applied to producing a series of consecutive instantaneous photographs of objects in motion, so as to reproduce the motion, was suggested by something I had read, and the fascinating thought persisted in my mind until the Anschutz tachyscope I saw at the Chicago World's Fair in 1893 brought a realization of its actual accomplishment . . .

In the summer of 1894 I saw at Washington the first exhibition there of the Edison kinetoscope. It interested me greatly. About that time Mr. H. A. Tabb . . . endeavored to interest me in a business way in the kinetoscope. He gave me glowing accounts of the public interest in kinetoscope exhibitions and of the profits to be made therefrom.

After investigating the matter I told Mr. Tabb that I could not see anything very promising in the kinetoscope as a commercial project, but that I could see a lot in a machine of the kinetoscope type if the pictures could be projected upon a screen, and that I believed that I could devise such a machine.

Meeting With Jenkins

Mr. Tabb's answer to that was that he did not believe it was possible to project such pictures successfully, because . . . the Edison Company . . . had failed to do so, and he, therefore, did not believe it could be done. From what I knew of stereopticons it did not seem to me that the problem presented insuperable difficulties, and I began a research to find out all I could as to the state of the art and what, if anything, had been accomplished in the way of projecting such pictures upon a screen, at the same time starting preparations for experimental work.

In the fall of 1894 I enrolled as a student in the Bliss School of Electricity of Washington, D. C., largely for the purpose of acquiring practical information as to handling an arc light that I proposed to use in my motion picture projection experiments. When I explained my purpose to Professor Bliss, he told me that there was another student in his school who was also interested in motion picture experiments. A few days later, at one of the classes, Professor Bliss introduced to me C. F. Jenkins, the student in question. Jenkins was a stenographer in the Life Saving Service, a branch of the U. S. Treasury Department.

It developed that Jenkins, with the cooperation and assistance of Professor Bliss and E. F. Murphy, the latter having charge of the Edison kinetoscope in the Columbia Phonograph parlors in Washington, had assembled a modification of the Edison kinetoscope, in which all Edison parts, films, sprockets, etc., were used. Jenkins called this peephole machine a "phantoscope," and applied for a patent on it November 24, 1894. The patent was issued as No. 536,539 on March 26, 1895.

As the patent shows, the Jenkins modification differed from the kinetoscope only in respect to the shutter. Instead of using a rotating shutter with a slit in it for exposing the continuously running film over a stationary electric light bulb, Jenkins rotated the bulb itself. This modification accomplished no improvement in results. It amounted to a somewhat different way of doing the same thing in a somewhat less efficient manner. Its only virtue consisted in the possible avoidance of certain claims in the Edison kinetoscope patent, in which a specifically described shutter was included as an element. These claims were cited by the Patent Office against the Jenkins application.

Practically every night that we met at the Bliss School, Jenkins urged me to join with him in experimental work to develop a motion picture projection machine. He was fully convinced that

a successful projection machine could be built upon the principle of the continuously running film of the Edison kinetoscope type of exhibiting machine. I was not so certain about that, but I felt that an experimental start had to be made and the sooner the better, and finally agreed on March 25, 1895, to join with Jenkins under an agreement which he prepared. In April or May of 1895 we completed a projection machine built on the kinetoscope principle. The machine turned out to be a complete failure, for reasons now obvious to anyone familiar with motion picture projection problems.

After that I took complete charge of further experimentation, at my own expense, and finally we produced the first projection machine ever made that embodied an intermittent movement with a long period of rest and illumination of the pictures on the film. Application for patent on this machine was filed on August 28, 1895, and later issued to Jenkins and Armat as patent No. 586,953.

The Edison films we used (the only kind obtainable then) were all taken at the rate of approximately 40 per second. The machine could not run the films at more than half that speed, and it thus gave a slow-motion effect to all the scenes. It made a terrific noise. The sprocket and mutilated gear weighed more than a pound, and after a few experimental exhibitions the recesses in the driven gear were battered out of shape and made useless. The machine was never exhibited outside my office at Washington. I still have the original sprocket and mutilated gear.

Under date of August 30, 1895, Jenkins wrote his friend Murphy that the machine was a "grand success," but I regarded it as a complete failure so far as its having any commercial value was concerned, and addressed myself to the task of devising a practicable machine. This I accomplished a short time after the failure of the Jenkins and Armat machine, with a modification of the Demeny camera intermittent negative film movement, adapted to projection machine requirements. I hurriedly assembled a crude machine, tried it out and found it satisfactory. Immediately afterward I had a more substantial machine made, and with it gave a number of successful exhibitions in my office to friends and acquaintances. An account of this machine was published in the Baltimore *Sun* of October 3, 1895.

First Public Showings

In September, 1895, we took this machine to the Cotton States Exposition at Atlanta, Georgia. Subsequently I had two duplicate machines made and sent to us there for exploitation purposes. I obtained a concession from the Exposition authorities and built a theater in the grounds for giving exhibitions, with the thought that receipts from the theater would help to pay the exploitation expenses. The anticipated Exposition crowds did not materialize, the receipts were small, and a very considerable loss was incurred.

While at Atlanta, Jenkins borrowed one of the three machines, saying that he would like to take it to Richmond, Indiana, to give some exhibitions to his friends on the occasion of his brother's wedding, and that he would be back in a few days. Jenkins gave an exhibition with this machine in his brother's store in Richmond, as announced in the Richmond *Daily Telegram* of October 30, 1895.*

After Jenkins' departure from Atlanta I made some important improvements in the machine, including a loop, or slack-forming means, that improved the exhibitions and greatly reduced the wearing of the films. Subsequently I remodeled the machine, to give it a more commercial form.

In December, 1895, I got in touch with Messrs. Raff and Gammon of New York, who were the exclusive agents for the Edison kinetoscope and films. My idea was to arrange for a supply of films. In reply to a letter to them asking that they come to Washington to see my machine, I received an answer to the effect that they had no faith in motion picture projection machines, since they had endeavored to induce the Edison Co. to produce one and they had failed to do so, and they did not believe motion pictures could be successfully projected. After a further exchange of letters Mr. Gammon agreed to come to Washington if I should pay his expenses, which I agreed to do. Mr. Gammon arrived with a sort of apologetic air of having been fooled into a wild-goose chase. When I took him into the basement of my office and threw a picture upon the screen, his attitude underwent a complete transformation. His excitement and interest were most apparent.

The result of the interview was a contract under the terms of which Raff and Gammon undertook to furnish films and to manufacture a certain limited number of machines, and licenses were to be granted upon a royalty basis to users of the machines and films, with territorial restrictions. No machines under any circumstances were to be sold. The Edison Co. was to make the machines from a model I was to send them.

Mr. Edison wanted to see an exhibition of the machine before details as to the number of machines to be made by him, the supply of films, etc., were to be decided. It was arranged that I should give Mr. Edison an exhibition. I sent a machine over to the Edison Works at Orange, N. J., and later Messrs. Raff and Gammon and I went over from New York to give the exhibition. The exhibition took place in a large room in the Edison plant and the sheet was a large one.

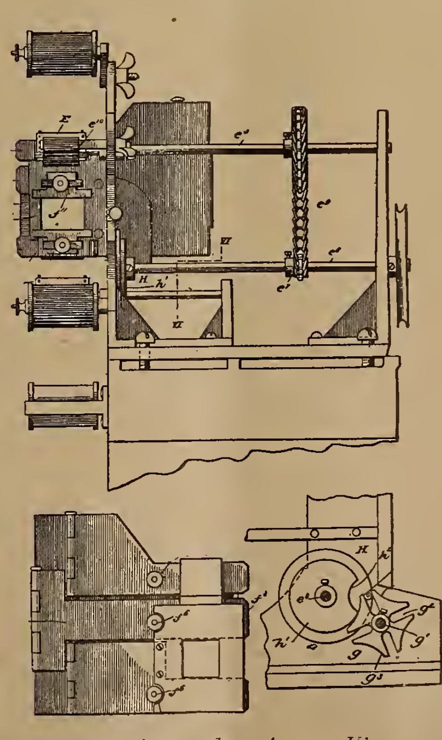
Edison Deal Arranged

Mr. Edison was obviously surprised at the excellence of the exhibition and so expressed himself. On the way back to New York Mr. Gammon told me that Mr. Edison had agreed to all our plans but expressed the opinion that we were planning to have more machines made than necessary. We planned to make eighty machines at first, but Mr. Gammon said that Mr. Edison believed that fifty machines would be sufficient to cover the country. This (oft-quoted) statement might seem strange coming from a man of Mr. Edison's vision, but it should be borne in mind that up to that date (February, 1896) no pictures of outside scenes had been taken by the Edison Co. The scenes were all such as had been taken in the Edison "Black Maria," as they called it, a sort of open-air, black-lined stage adapted to be rotated so as to face the sun. The necessity for bright sunlight was largely due to the high speed of taking. The pictures were restricted to such as could be taken in the limited space of the small stage, and they were all of vaudeville subjects.

Arrangements were made by Raff and Gammon to introduce the machine, or rather its exhibitions, to the New York public, and I was asked to come to New York to supervise the installation and operation of the machine. This I did, and on the evening of April 23, 1896, I gave at Koster and Bial's Music Hall in New York, the first exhibition ever given in a theater of motion pictures as we know them today, embodying, as such

(Continued on page 26)

*Editor's Note: It has been stated several times in the literature that C. F. Jenkins gave an exhibition with his projector at Richmond, Indiana, on June 6, 1894, but no proof of this earlier date has been obtained by the Historical Committee. A photographic copy of the Richmond *Daily Telegram* for Oct. 30, 1895, describing the showing on October 29, 1895, is in the files of the S.M.P.E. Historical Committee.



Drawings from the Armat Vitascope patent No. 578,185, *dated March* 2, 1879, *showing the intermittent movement employing the star-wheel, or Geneva cross*

Current showings of "Becky Sharp," first all-color feature length production, have made the motion picture industry acutely color conscious. Appended hereto are two contributions by Technicolor representatives to a color symposium sponsored recently by the Academy of M. P. Arts & Sciences, which detail the technical and artistic phases of the art. "Becky Sharp" induced widely varying critical comment by the lay press; and while the trade press was non-committal, as usual, it is apparent that the bulk of the industry opinion on color is frankly skeptical.

The Technicolor Process of 3-Color Cinematography

By J. A. BALL*

IN the earliest days of the Technicolor development, we recognized that the ultimate goal of workers in the field of color cinematography must be a process which would add a full scale of color reproduction to the existing black-and-white product without subtracting from any of its desirable qualities, without imposing any complications on theatre projection conditions, and with a minimum of added burden in the cost of photography and in the cost of prints. These considerations seemed to clearly indicate a three-color subtractive printing process capable of ultimate low cost of manufacture.

In those days, most other efforts to develop a subtractive printing process made use of double-coated positive stock, invented about 1912 by Hernandez-Mejia. We found a number of objections to the use of this stock; particularly, to the spatial separation of the two components, to the susceptibility to scratching during processing and projection, but most of all, to the impediment imposed upon an ultimate three-color result.

Surveying the field, we chose to work on the multi-layer, or monopack, process, and the imbibition process. In a monopack process the several components are in successive layers all coated on the same side of the film strip. In the imbibition process, the several components consist of images formed in water soluble dyes printed onto, or rather into, a gelatine-coated film strip much as colored ink images are printed onto paper in the process of photo-lithography.

Monopack Color Process

A multi-layer, or monopack, process can theoretically be used as a taking process and as a printing process; whereas imbibition, being a photo-mechanical process, is limited to use as a printing process and requires to be supplemented by a taking method, preferably one providing distinct separation negatives. As printing processes, both monopack and imbibition yield a final product containing all components on one side of the film strip and with no limitation as to their number.

Some fundamental and far-reaching work on the monopack process by the late Dr. Troland, who at the time of his death was Research Director of Technicolor, resulted in the issuance in 1932 of Reissue Patent No. 18,680, containing two hundred and thirty-nine claims, broadly covering this field both for taking and printing. The imbibition process seemed to present a less formidable array of processing problems than did the monopack process, so we pushed its development with even greater effort.

We found it necessary to split the problem into two stages. As the first step in an imbibition process it is necessary to prepare a film bearing images consisting of a raised relief of hardened gelatine. This relief image, or matrix, serves the same purpose as the etched copper or zinc plate of photo-lithography. First, we had to find out how to make a gelatine relief suitable for use as a printing plate. We decided to content ourselves temporary with two components and to stop short of actual imbibition by making use of an intermediate process wherein two gelatine reliefs, produced on thin celluloid, were glued together back-to-back and dyed up in complementary colors.

Prints of the Technicolor sequence in "The Ten Commandments," and of Douglas Fairbanks' all color picture, "The Black Pirate," were made in this manner.

Then, after having learned how to make gelatine relief matrices of good quality, we tackled the problem of making adequate transfers from those matrices. We had to learn how to prepare the blank film so as to permit imbibition without diffusion. We had to devise a transfer machine capable of handling film in long lengths and in quantity, and on which blank and matrix could be brought into registered contact and held there for several minutes while the dyes transferred.

Simultaneously we devised a camera which gave two-color separation negative images free not only from fringing and parallax but also free from the harmful effects of celluloid shrinkage. In this camera the two images were in symmetrical pairs, one being the mirror image of the other. These were arranged on a single strip of negative stock with both members of the symmetrical pair positioned accurately with respect to symmetrically adjacent pairs of perforations. The perfect geometric symmetry of this arrangement is shrinkage-proof during the entire life of the negative. The very compact prism system of this camera permitted the use of relatively short focal length lenses. The aberrations of the glass path were taken into account in the computations for these lenses.

Two-color imbibition prints were brought out commercially in 1928, just about the time that sound swept the industry. We were then immediately faced with the necessity of combining color with sound. The only procedure obvious at that time was to make the sound track identical with one or both of the picture components; but this would give a sound track in dye, which would have varying absorption throughout the range of wave-lengths to which photo-electric cells are sensitive. The response from such a track would then, of course, be different for one type of cell than for another type of cell, and especially so in the case of a variable density track.

We avoided this problem by starting, not with a blank film, but with a strip of positive stock on which the sound track could be printed and developed in silver while leaving the picture area blank. Imbibition transfer of the picture components into this blank area could then take place. This method is capable of giving a sound track absolutely identical with that used in the black-and-white art.

Better yet, because of the complete separation of the sound track technique from the picture technique, the necessity of any compromise between sound and picture quality is eliminated and

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ideal sound track processing conditions are possible. Many millions of feet of two-color imbibition prints with a silver sound track were produced by Technicolor in 1929 and subsequent years.

The Three-Color Process

We were now ready to move on to a three-color process. Since we had planned on it from the beginning, we encountered no fundamental impediment in our printing process. Mechanically, we had merely to combine the imbibition paths in groups of three instead of in pairs.

The proper choice of dyes presented more of a problem. In a two-color process many colors are compromised, so to speak, and there is considerable choice as to the manner and extent of compromise. In a three-color process, the accuracy of reproduction is greatly increased and the freedom of choice is greatly restricted.

An adequate three-color camera was an exceedingly difficult problem. Those three-component taking methods which use only a single aperture (monopack, screen plates, and lenticulated films), have advantage of economy of light and of mechanism, but they all have other disadvantages, particularly when it comes to separating or differentiating between the various components; and some of them present difficult raw stock manufacturing problems.

On the other hand, cameras which split the light to three separate apertures, while photographically and optically simple, have the disadvantage of loss of light in the splitting process, long or complicated optical paths, increased size, and mechanical complexity. We chose as a favorable middle-ground solution an intermediate line of attack wherein *three* records are obtained at two *apertures.*

Figure 1 shows schematically the arrangement of optical parts and films in this camera. In making use of a bipack at one aperture, we have incorporated means for the practical elimination of halation and also for the elimination of any dependence on the surface coating of one of the films for the exact determination of our red light filter. Thus, two of the most serious faults of ordinary bipacks have been removed.

To insure that there shall be no differential shrinkage amongst the three strips of negative, we specify that the celluloid base shall be of the low-shrinkage type as made by Eastman. This low-shrink celluloid base is of such quality that after processing the negative, including the manufacture of a volume of release prints, the shrinkage is approximately 1/8 of 1%, with differences in shrinkage amongst the members of a group of about 1/8 of the total shrinkage. This amounts to a small fraction of 1/1000″ across the longest dimension of the picture and is therefore entirely negligible.

A group of five lenses ranging in focal length from 35 mm. to 140 mm. have been designed for this camera to our specifications by Messrs. Taylor, Taylor and Hobson. The chromatic correction of these lenses has been designed to give, in cooperation with our film arrangement, three images of unusually high correction, thus compensating for the loss of definition in the red record of the bipack. The most notable feature of these lenses, however, is the inclusion in the 35 mm. design of what might be called the inverse telephoto principle whereby the back focal length is considerably longer than the equivalent focal length.

The 'How' of Technicolor

For the benefit of those to whom the reproduction of color is somewhat of a mystery, a brief outline of the complete process as we now work it is perhaps desirable.

The Technicolor three-color camera photographs the three primary aspects of a scene (red, green, and blue) onto three separate film strips, simultaneously, at normal speed, without fringe or parallax, in balance, and in proper register with each other. These separate strips are developed to negatives of equal contrast and must always be considered and handled *as a group.*

From these color separation negatives, we print by projection through the celluloid of a specially prepared stock which is then developed and processed in such a manner as to produce positive relief images in hardened gelatine. These three hardened gelatine reliefs are then used as printing matrices which absorb dye and then transfer this dye by imbibition printing onto another film strip which, when it has received all three transfers, becomes the final completed print ready for projection. To carry on the process of imbibition, it is merely necessary to press the matrix film into close contact with a properly prepared blank film and hold it there for several minutes. Matrices, of course, can be used over and over again.

Photographic Principles

The colors of dyes used in the transfer process must be the subtractive primaries, namely, minus-red (or cyan), minus-green (or magenta), and minus-blue (or yellow). The relation of the taking colors to the printing colors is made clear in Figure 2.

The process just described is designed to reproduce whatever was placed in front of the camera, not only as to color but also as to light and shade. But even the best of reproduction procedures, even that of oil painting on canvas, is rather severely limited when it comes to reproducing light and shade. The contrast from whitest white to blackest black in a painting is perhaps 1 to 32. Upon projection from transparencies, as in motion picture work, the range may be slightly greater, about 1 to 64, but in no case is the great range of sensitivity of the eye adequately reproduced. The art of painting and the art of photography then, have this in common: they seek to suggest a great range of visual contrasts by a skillful use of the more limited contrasts available in the method of reproduction.

In color photography, all very full exposures tend to bleach out to white and all low exposures tend to drop into black. A high-light on a face in black-and-white photography can, in the final print, be merely the bare celluloid and the result will be still entirely satisfactory; but if, in a color print, such a condition exists, the delicate flesh tint will, in that area, be bleached out to white and the face will look blotchy.

All areas of the face should, therefore, be reproduced in such a manner as to yield a good flesh tint. Very light make-ups, and oily makeups having considerable shine are apt to be troublesome. In any case, it is necessary to control the light and lighting contrasts accurately and to avoid "hot spots."

The art of the color cinematographer is intermediate between that of the painter and that of the stage artist. The painter has to work with pigments having a limited range of contrast but has great freedom of choice as to composition. The stage artist works with light and so does not encounter the pigment limitation, but he must select his costumes, backgrounds, etc., to be harmonious in a great variety of arrangements, most of which are more or less out of his control. In color cinematography the difficulties of both are combined; there is the pigment limitation combined with the comparative lack of control of composition.

To illustrate this difference let us take, for example, a scene wherein a figure clad in white is to be illuminated by

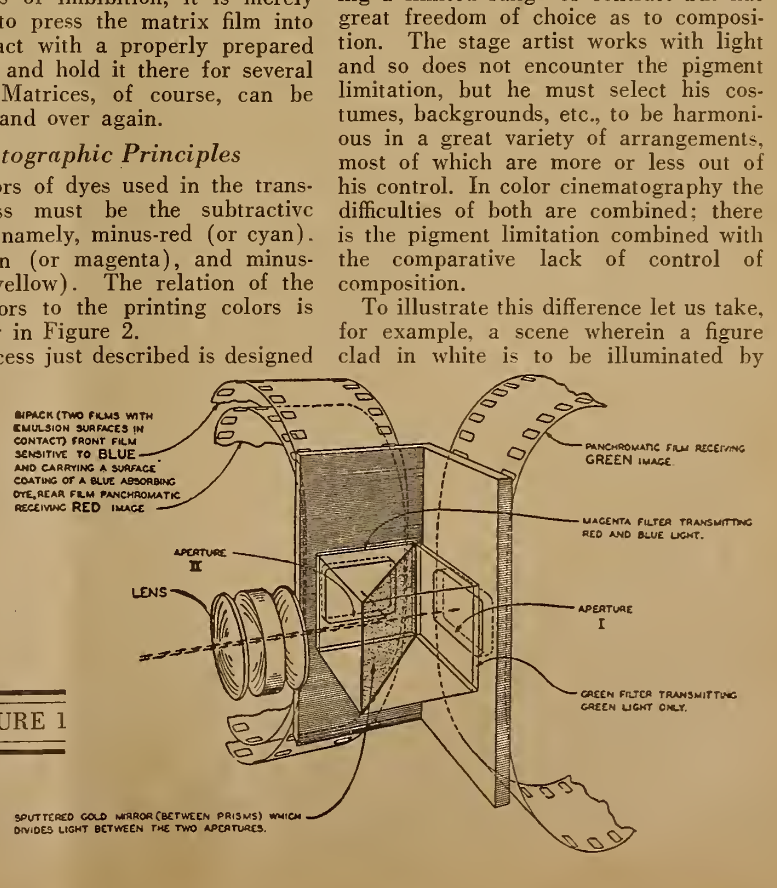


FIGURE 1

red light, as from a fire which is not visible to the audience. The stage artist, in arranging such an effect, must have a suitable background for the figure when it is viewed from a great many different angles. In arranging his lights, however, he can call for more and more intense beams of red light until he has achieved the desired effect.

If a painter is endeavoring to get the same effect in a painting, he can select a favorable pictorial composition, but to depict the red illumination he can only use the brightest red pigment in his palette. If he is dissatisfied with his first effort, he cannot heap on more and more of his red pigment. Obviously nothing is to be gained in that manner. He can only improve his result by suppression of, or contrast with, the background.

Now, in color cinematography, the brightest red that is available is the full value of red pigmentation in the film, and this is obtained by full value of the magenta and yellow dyes without any cyan dye. These conditions result from full exposure of the red negative with no exposure in the green and blue negatives. If the color cinematographer is not satisfied with this full pigmentation and endeavors to get a more intense red by piling on more red light in front of the camera, he merely over-exposes the red negative and begins to get some exposure in the green and blue negatives. The corresponding areas in the print tend to bleach out to white.

The significance of the pigment limitation can be summed up in a very few words; if the desired effect can be shown in a painting, it can be photographed, and if it cannot be painted, it probably cannot be photographed. While no such brief statement is ever strictly true, this one contains such a large percentage of truth that it is worthy of being set up as a guiding principle.

Color Photography Lighting

In color photography, it is necessary to operate at rather high levels of illumination. If one is not careful, this may lead to a condition like this: given only relatively weak light sources, one finds it necessary to use a great many of these sources, in order to attain an adequate level. The widespread distribution of these units then tends to kill all shadows and eliminate modeling on faces. If, then, the attempt is made to provide modeling by superimposing a localized shaft of light as from a spot light, the face is burned up, blotchy and generally unrecognizable.

The way out of this dilemma is to recognize that modeling should properly be produced by shadows, and to use fewer and brighter sources or to mass the sources of illumination so that shadows have a chance to exist. In other words, it is just as important for the cameraman to determine directions from which light shall *not* come as it is to determine directions from which light *shall* come.

While color contrasts will occasionally produce a pleasing result when flatly lighted, that is not the way to get sharp photography, nor in general, the most pleasing photography. The Technicolor process is capable of reproducing a full scale of contrasts and those effects of light and shade (chiaroscuro) and those directional effects so striking in black-and-white are even more effective in color.

These considerations apply not only to the lighting of figures and faces but also to the design and lighting of sets. In the design and painting of sets, the art director should have in mind the cameraman's problem of achieving the necessary light levels with a minimum number of sources of illumination. Under these conditions, it is always much easier to keep parts of a set in low key by keeping light away from them, than it is to paint them dark and then be forced to illuminate them strongly.

Carbon Arc Lighting

This need for fewer and brighter sources is one of the reasons why we choose carbon arcs in preference to incandescent tungsten lamps. Another reason is the fact that only in the white-flame carbon arc and in sunlight do we find the correct balance of blue and red components for the photographic emulsions with which we have to work. If tungsten lamps were to be used, it would be necessary to throw away the excess red light by the use of blue glass bulbs or overall filters. An added reason for the use of arcs is that at the high levels of illumination which we require, the heat rays emitted by incandescent lamps are a serious problem. Arcs radiate more light and very much less heat.

If incandescent units were properly filtered to correct the color of the light and to absorb heat rays they would undoubtedly be useful on special occasions.

Special arc units have been developed by the National Carbon Co. and Mole-Richardson for use in connection with the Technicolor three-component process. They have been designed to solve some of the earlier difficulties with arcs, especially noise and flicker. The older type of arcs also gave off some smoke which appeared as carbon dust in the air, but it is possible to incorporate absorptive means in the vents to absorb this smoke. The only drawback to the use of arcs is the necessity for "time out" for retrimming, but this can usually be made to coincide with other "time out" activities, particularly if the head electrician works closely with the director.

There is no danger of Kleig eyes when using arcs, providing only that a sheet of ordinary glass is between each arc and the eyes of the people. This is a simple enough requirement and entirely eliminates any danger.

The required level of illumination is not very different from that which was in use by many black-and-white cameramen before the introduction of supersensitive film. We have devised methods of measurement of illumination levels for the guidance of the cameraman.

Exterior Color Photography

Exterior photography divides itself into four classifications:

(A) Sunlight shots wherein the scenery is of maximum importance. These occur abundantly in travelogues and scenics and quite frequently in dramatic photography, especially in the establishing long shots.

(B) Sunlit shots wherein faces are of greatest importance.

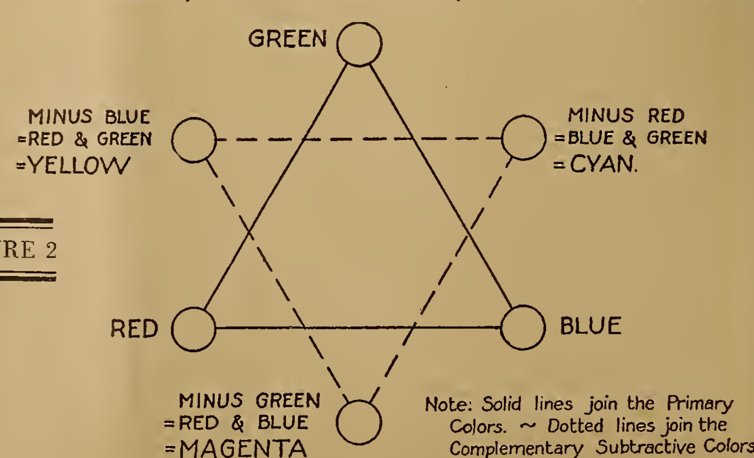
(C) Imitation sunlit exteriors built on a dark stage and artificially illuminated.

(D) Night exteriors.

In group A there are pronounced differences between color and black-and-white photography, because color photography can reproduce those pleasing color contrasts of sky, water, blue haze, foliage, beach, etc., which are almost entirely lost in black-and-white. Furthermore, there is always a strong directional effect to the sunlight with very pronounced shadows. A front crosslight is best in color, whereas a side or back cross would generally be preferred in black-and-white.

In class B it must be realized that few faces will stand the harsh lighting of the direct sun as in a front cross-lit setting. So gauzes, diffusers, reflectors, and sometimes "booster" light, must be called into use. Conditions are then most favorable if the sunlight comes from behind the figure. This is true in color or in black-and-white. The skillful cameraman takes advantage of the changing directions of sunlight throughout the day to schedule his shots and

FIGURE 2



angles for best results. Cooperation between director and cameraman in such cases is even more important than in the case of exteriors.

It is, of course, perfectly obvious that if artificial light is to be mixed with daylight, as in the case of "booster" light, that the color of the "booster" light must approximate sunlight. Here again the use of carbon arcs in preference to incandescent lights is clearly indicated. One might wonder if the change in sunlight quality from morning to late afternoon might not show on the screen in abrupt changes in color of successive scenes. We have found it generally possible to correct for any such differences in the printing. Such correction, however, is not possible where one encounters simultaneously very yellow light from the sun with blue shadows illuminated from a clear sky. Such an effect will, of course, carry through to the screen and a very beautiful effect it is, too.

The set-ups of group C are very troublesome if the illusion of reality is of importance. This illusion almost always is important in a motion picture so that the artificialties of the usual stage lighting are scarcely acceptable at all. Shadows can perhaps still be painted on buildings, walls and backgrounds but of course not on people. Nor can the shade of a tree be so imitated. What is really needed is a light source of greater power than any now available. Pending its development, the well-known California sun promises to return to its former importance. In other words, sizeable sunlit exteriors to be photographed in color had best be real. The difficulties of imitating grass, shrubs, etc., also argue in the same direction.

In the case of night exteriors (class D), color has one great advantage over black-and-white in that it is possible to contrast moonlight and lamplight for example by the use of blue and amber filters.

Technicolor adds practically no complications to sound recording other than a somewhat noisy camera and the necessity of eliminating "whistle" from the arcs. If the camera is adequately blimped, the problem of camera noise is solved forthwith. The whistle caused by high-frequency ripples in the electric current coming from the commutator of d.c. generators can be practically removed by the combination of an alternating current filter at the generator and additional choke coils at the individual arc units.

When we come to the trick department, however, color has its special problems. Fades, lap-dissolves, wipe-offs, etc., can all be made by duping all three negatives and taking pains to preserve the register, exposure, and contrast balance. Those methods of composite photography which depend on color differences cannot be used in Technicolor. The projection background process is, of course, ideal for trick shots in color. However, there is the problem of adequate illumination of the projection screen.

So far, projected backgrounds have been used in Technicolor only in relatively small areas such as through the rear window of a taxi or limousine. Eventually, we hope to be able to work out means for handling projection backgrounds in very much larger sizes, but at present we are rather restricted.

Conclusion

There is a general appreciation of the fact that "color is coming." When sound swept the industry several years ago, it meant the introduction of a new and different technique, and of men of new and different training. The sound engineer was the "big shot." The cameraman was locked in a padded cell with his camera, and the art director was told how he could and could not construct his sets to meet the new acoustic considerations.

Conditions will be much more enjoyable for everyone concerned when color sweeps the industry. The sound men will not be affected in any way at all but the cameraman and the art director will be given new tools to work with whereby the value and importance of what they can contribute to a picture will be greatly increased. For these reasons it is to be expected that the technicians generally will be enthusiastic and cooperative with the rising tide of color.

It is the policy of the Technicolor Co. to organize and maintain a nucleus camera department and color art department for the purpose of accumulating experience and disseminating information and advice as to the skillful and effective use of Technicolor. Beyond this nucleus the policy is to invite cooperation from the studio organizations and especially from those cameramen and art directors who desire to continue to lead in their respective fields.

These men will generally be surprised first at the extent to which their conscious sense of color has become atrophied through lack of use while working in black-and-white, and second, at the speed with which they can regain it, and third, at the utter inadequacy of black-and-white photography in comparison with good color photography.

When our color was of inferior quality, we used to hear the expression "color interferes with the drama." Since the introduction of the three-component process, the expression has been rapidly fading out of use. Good color assists good drama. This policy is continuing and the work involves nearly all departments. We propose to continue to improve our product until the last doubter is swept off his feet.

Color Consciousness

By NATALIE KALMUS*

FROM a technical standpoint, motion pictures have been steadily tending toward a more complete realism. In the early days, pictures were a mere mechanical process of imprinting light on film and projecting that result onto a screen. Then came the perfection of detail—more accurate sets and costumes, more perfect photography. The advent of sound brought increased realism through the auditory sense. The last step, color, completes the process. Now motion pictures are enabled to faithfully duplicate all the auditory and visual sensations.

The eye is the organ of perception. The impulses of light received by the retina are transferred over the optic nerve path to the brain, and we become conscious of light and dark, motion, form, and color. Vision is a sense of ancient lineage and of early development in the individual life. Its characteristic is the clearness and precision of the data it furnishes the mind. Compared to sight, the other senses are dull and groping. It is the sense by which we receive the greatest number of stimuli from the world about us. It is the sense which most frequently affects the nervous system, dominates the attention, and stimulates the mind.

It is a psychological fact that the nervous system experiences a shock when it is forced to adapt itself to any degree of unnaturalness in the reception of external stimuli. The auditory sense would be unpleasantly affected by hearing an actor on the screen speak his lines in a monotone. The mind would strive to supply the missing inflections.

Glaring Combinations Taboo

The same is true, but to a greater degree, of the visual sense. A superabundance of color is unnatural, and has a most unpleasant effect not only on the eye itself, but on the mind as well. On the other hand, the complete absence of color is unnatural. The mind strives to supply the missing chromatic sensations, just as it sought to add the missing inflections to the actor's voice. The monotony of black, grey, and white in comparison with color is an acknowledged fact.

Obviously it is important that the eye be not assailed with glaring color com-

* Color Director for Technicolor Corp.

binations, or by the indiscriminate use of black and white. Again taking our cue from Nature, we find that colors and neutrals augment each other. The judicious use of neutrals proves an excellent foil for color and lends power and interest to the touches of color in a scene. The presence of neutrals in our composition adds interest, variety and charm to our colors. On the other hand, the presence of color in our picture gives added force to the neutrals, emphasizing the severity of black, the gloominess of grey, the purity of white.

The usual reaction of a color upon a normal person has been definitely determined. Colors fall into two general groups—first the "warm," and second the "cool" colors. Red, orange, and yellow are called the warm or advancing colors. They call forth sensations of excitement, activity, and heat. In contrast, green, blue, and violet are the cool or retiring colors. They suggest rest, ease, coolness. Grouping the colors in another manner we find that colors mixed with white indicate youth, gaiety, informality. Colors mixed with grey suggest subtlety, refinement, charm. When mixed with black, colors show strength, seriousness, dignity, but sometimes represent the baser emotions of life.

As to the use of a single color alone, each hue has its particular associations. For example, red recalls to mind a feeling of danger, a warning. It also suggests blood, life and love. It is materialistic, stimulating. Different shades of red can suggest various phases of life such as love, happiness, physical strength, wine, passion, power, excitement, anger, turmoil, tragedy, cruelty, revenge, war, sin, and shame. These are all different, yet in certain respects they are the same. Red may be the color of the revolutionist's flag, and streets may run red with the blood of rioters, yet red may be used in a church ritual for Pentecost as a symbol of sacrifice.

Whether blood is spilled upon the battlefield in an approved cause or whether it drips from the assassin's dagger, blood still runs red. The introduction of another color with red can suggest the motive for a crime whether it be jealousy, fanaticism, revenge, patriotism or religious sacrifice. Love gently warms the blood. The delicacy or strength of the shade of red will suggest the type of love. By introducing the colors of licentiousness, deceit, selfish ambition or passion, it will be possible to classify the type of love portrayed with considerable accuracy.

Color Associations

Proceeding to the other colors, orange is bright and enlivening; it suggests energy, action.

Yellow and gold symbolize wisdom, light, fruition, harvest, reward, riches, gaiety; but yellow also symbolizes deceit, jealousy, inconstancy in its darker shades, and particularly when it is tinged with green.

Green immediately recalls the garb of Nature, the outdoors, freedom. It also suggests freshness, growth, vigor. Dark green, blue, violet and indigo are cooling, quiet colors. They are tranquil and passive. They do not suggest activity, as do the reds and orange. Blue is suggestive of truth (true blue) calm, serenity, hope, science, also cold steel, melancholy (we have the expression "blue as indigo").

Purple is a man-made color which does not occur in the spectrum. It is a combination of warm red and cool blue. It will be aggressive and vital if the red predominates, or dignified and quiet if the blue overbalances the red. Purple denotes solemnity, royalty, also pomp and vanity.

Magenta is the combination of purple and red. It is very distinctly materialistic. It is showy, arrogant and vain.

The neutrals; white, grey, and black, while theoretically not in the category of colors, also stimulate very definite emotional responses. Black is no color, but absorption of all color. It has a distinctly negative and destructive aspect. Black instinctively recalls night, fear, darkness, crime. It suggests funerals, mourning. It is impenetrable, comfortless, secretive. It flies at the masthead of the Pirate's ship. Our language is replete with references to this frightful power of black—Black Art, black despair, black-guard, Blackmail, Black Hand, the Black Hole of Calcutta, Black Death (the devastating plague of Medieval Europe), black list, black-hearted, etc., etc. We are speaking a potent language to our audience when we make use of black.

Grey suggests grey skies and rain. It is gloomy, dreary, and represents solemnity and maturity. From its complete neutrality and lack of any color or distinctiveness, it represents mediocrity, indecisiveness, inaction, vagueness.

White reflects the greatest amount of light, it emanates a luminosity which symbolizes spirit. White represents purity, cleanliness, peace, marriage. Its introduction into a color sublimates that color. For example, the red of love becomes more refined and idealistic as white transforms the red to pink. White uplifts and ennobles, while black lowers and renders more base and evil any color. To the degree which colors are lightened or darkened will the qualities which the color exemplifies be altered.

Thus we see that all the colors in the spectrum speak their particular language. The flush of anger, the vigor of

N. Y. Press Comment on "Becky Sharp," First All-Color Feature Film

Daily News—The spectators came with the expectation of being bowled over by something entirely new in the way of color photography. They were, I'm afraid, disappointed on that score, but they remained to applaud the efforts of all those concerned in the making of a picture that is endowed with a great deal of pictorial beauty . . . . Color photography is still in the experimental stage . . . . The success of "Becky Sharp" demonstrates that color has a definite place in the scheme of pictures . . . .

American— . . . this department predicts that it (color) will be henceforth as important to the cinema as "The Jazz Singer." Though color is introduced, Director Mamoulian has not brutally taken advantage of it . . . .

Evening Journal— . . . a great improvement over the earlier experiments in color photography. Visually "Becky Sharp" is charming. Cool blues, pale yellows and bright reds are assembled with a genuine color sense and blended with artistic effect. . . . But color is still a novelty, and it is still too early to say whether, as its sponsors hope, it can replace the black and white of the screen.

Daily Mirror— . . . a truly beautiful film. The color is exquisite. Subtle olive greens, turquoises, flames, pearls are captured by the camera with accurate fidelity. No previous color picture compares with "Becky Sharp."

Herald-Tribune—The most important cinematic experiment since moving shadows first became articulate. . . . As a dramatic entertainment it has its faults, and some of these stem from the experiment itself, but as the first serious step in an uncharted field it is a considerable triumph. . . . When color is employed too profusely it definitely diverts one's attention from the dramatic action, a recurrent fault in "Becky Sharp." And, except in the dimly lit passages, it is curiously flat, with scant graduation in tone and almost no dimensional addition to cinematic technique.

Post—Not that the black and white film is to vanish overnight, but it is in the death throes, and the knell was sounded yesterday with the arrival in glorious raiment of "Becky Sharp." . . . It is an exciting adventure in a new medium, a finger pointing dramatically toward hitherto unrealized possibilities in the motion picture art. . . . From a scientific standpoint there undoubtedly is room for improvement. In certain dissolves the color transition seems wobbly. . . . What impressed me in "Becky Sharp" is the added dimension which color gives and the use made of that color not only esthetically but in foreshadowing and scoring the dramatic implications of the story.

Sun— . . . in spite of all the ballyhoo, color photography still has its faults, and serious ones. Even the charm and quaintness of the settings could not conceal the metallic quality of the sound production, the difficulty in matching up skin tones in close-ups and near-shots. The tendency of the light to fade and suddenly brighten. . . . The picture, as drama, is both helped and hindered by its insistence upon color. . . . The difficulty of cutting from one color sequence to another, without too much distracting attention from the story, is one of the many problems that Hollywood will eventually have to solve. Color-photography of course will some day be taken for granted. That day does not seem to be yet upon us. Hollywood, cautiously watching the opening of "Becky Sharp," need not hysterically throw away its reliable black-and-white cameras.

World-Telegram—The general effect, then, is fascinating. The new process is soothing to the eye and it is sharply defined, but, largely because of the expert manner in which certain colors have been grouped, it does not jump up and slap you in the face. Indeed, there are times when one is scarcely conscious of color at all.

It is at its best in close-ups and when certain solid colors, like a pure red, are used. When it attempts to mix two colors to get another it loses its vitality, and in moderately long shots except when vivid colors are used, it becomes blurred. . . . If it is skillfully blended with story, acting, direction and dialogue it can bring a tempo and an excitement to films that are missing in black and white photography.

Times— . . . Probably the most significant event of the 1935 cinema. . . .Certainly the photoplay, coloristically speaking, is the most successful that has ever reached the screen. . . . It possesses an extraordinary variety of tints, ranging from placid and lovely grays to hues which are vibrant with warmth and richness. This is not the coloration of natural life, but a vividly pigmented dream world of the artistic imagination. . . .

Some of the color combinations make excessive demands upon the eye. Many of them are as soothing as black and white. The most glaring technical fault, and it is a comparatively minor one, is the poor definition in the long shots, which convert faces into blurred masses. In close-ups where scarlet is the dominant motif, there is also a tendency to provoke an after-image when the scene shifts abruptly to a quieter color combination. . . . The major problem, from the spectator's point of view, is the necessity for accustoming the eye to this new screen element. . . .

But one thing is certain about "Becky Sharp." Its best is so good that it becomes a prophecy of the future of color on the screen. It forced this column to the conclusion that color will become an integral motion picture element in the next few years.

a sun-tanned skin, the richness of gold velvet, the violet mystery of distant mountains, the serenity of blue sky—these colors alone speak with more eloquence than could be described by words.

Preparing the Picture

In the preparation of a picture we read the script and prepare a color chart for the entire production, each scene, sequence, set, and character being considered. This chart may be compared to a musical score, and amplifies the picture in a similar manner. The preparation of this chart calls for careful and judicious work. Subtle effects of beauty and feeling are not obtained through haphazard methods, but through application of the rules of art and the physical laws of light and color in relation to literary laws and story values. In the first place, this chart must be in absolute accord with the story action.

Again, it must consider the art, principles of unity, color harmony, and contrast. Again, it must consider the practical limitations of motion picture production and photography. The art director, however, in handling a color picture, must be forever mindful that the human eye is many times more sensitive than the photographic emulsion and many times greater in scope than any process of reproduction. Therefore, he must be able to translate his colors in terms of the process.

When we receive the script for a new film, we carefully analyze each sequence and scene, to ascertain what dominant mood or emotion is to be expressed. When this is decided, we plan to use the appropriate color or set of colors which will suggest that mood, thus actually fitting the color to the scene and augmenting its dramatic value.

We plan the colors of the actor's costumes with especial care. Whenever possible, we prefer to costume the actor in colors that build up his or her screen personality. In a picture which we recently completed, two young girls play the parts of sisters. One is vivacious, affectionate and gay. The other is studious, quiet and reserved. For the first we planned costumes of pink, red, warm browns, tan and orange; for the second, blue, green, black, and grey. In this way the colors were kept in unison with their film characters.

One very important phase of making color pictures is the necessity of obtaining distinct color separation. The term "color separation" means that when one color is placed in front of or before another color, there must be enough difference in their hues to separate one from the other photographically. For example, there must be enough difference in the colors of an actor's face or costume and the walls of the set to make him stand out from the colors in back of him; otherwise he will blend into the background and become indistinguishable, as does a polar bear in the snow. If the colors are properly handled, it is possible to make it appear as though the actors were actually standing there in person, thus creating the illusion of the third dimension.

Because of the general warm glow of flesh tints, we usually introduce the cooler tones in the backgrounds, but, if we find it advantageous to use warmer tones in the set, we handle the lighting so that the particular section in back of the actor is left in shadow. This gives a cool contrast to the faces, even though we have a general feeling of warmth in the room. When there are a number of players, all wearing different colored costumes, it is necessary to disregard those playing relatively unimportant parts, and make the background in contrast to those whose action is most significant to this particular scene.

Color Picture Sets

It is important that the sets have interest and variety. They must not be flat. When the sets have depth it is much easier to introduce interesting shadows and colored lights for special effects.

Unless the dramatic aspect dictates to the contrary, it is desirable to have all the colors in any one scene harmonious. Otherwise, we strike an unpleasant, discordant note.

A point to be considered in set dressing depends upon one of the rules of composition in art. The law of emphasis states in part that nothing of relative unimportance in a picture shall be emphasized. If, for example, a bright red ornament were shown in back of an actor's head, the bright color would detract from the character and action. Errors of this nature must be carefully avoided.

Color Juxtaposition

The effect of "color juxtaposition" is an apparent change of hue when different colors are placed one over the other, or side by side. If two cards, one orange, the other blue-green are placed side by side, the orange will appear more red than it really is, the blue-green more blue. Each color tends "to throw" the other toward its complement. In other words, the complement of orange is blue, therefore, the orange makes the blue-green appear bluer. When any two colors are placed together, the first emphasizes in the second the characteristics which are lacking in the first.

It can readily be seen from this how exceedingly important it is to consider the movement in the scene in determining its color composition because the juxtaposition of colors is constantly changing due to this movement. Quite a different problem from that of an artist, who paints a still scene where the characters remain in their set places, and whose color values, therefore, are not subject to frequently changing contrast.

We must constantly practice color *restraint*. In the early two-color pictures, producers sometimes thought that because a process could reproduce color, they should flaunt vivid color continually before the eyes of the audience. This often led to unnatural and disastrous results, which experience is now largely eliminating.

The synthesis of all these factors entails many conferences with directors, art directors, writers, cameramen, designers and others. Technicolor color directors, cameramen and technicians act in a consulting and advisory capacity to the various studio departments both during the preparation and the shooting of the picture.

Music, graphic art and acting have now been united and become one expression of more ultimate art. Now for the first time a perfect expression of the combined inspirations of producer, writer, artist, actor and musician can be adequately presented to an audience. Color has touched the sound picture and it fairly lives.

Academy's Studio-Theatre Coordination Program

CLOSER contact between the production and exhibition ends of the industry is the goal of an ambitious educational program launched recently by the Academy of M. P. Arts & Sciences through the medium of a questionnaire which has been sent to projectionists and managers of 6,000 theatres throughout the United States.

A copy of the questionnaire is appended hereto for the convenience of those who may not receive it direct.

Upon the answers obtained from the questionnaire now being distributed depends the Academy program of releasing periodically to managers and projectionists a series of informative bulletins which will outline in a general way the technique of recording and photography. Questionnaire replies will determine the content of these bulletins.

The Academy plan in general has been endorsed by the Projection Practice Committee of the S. M. P. E., which has offered to assist the Academy in every way possible in order to insure success of this program. In fact, the S. M. P. E. Committee itself contemplated just such a move, only to be blocked by the opposition of certain members who felt that the Academy program would be detrimental to the circulation or sale of of their writings. I. P. has absolutely no objection to the plan, provided that no hint of commercialism with respect to service or equipment sales attaches thereto.

Plan Bulletin Service

In a letter to I. P., Gordon S. Mitchell, manager of the Academy Research Council, stresses the desirability of closer contact between studios and theatres and continues: "It was decided to query a large group of managers and projectionists as to their opinions on the value

of a series of informative bulletins, outlining . . . the technique of recording and photography . . .

"The Committee in charge of this project . . . has asked me to send a copy of this material to you and to request that you give this survey as wide and as favorable publicity as possible . . . You might reproduce the questionnaire to allow those projectionists and managers who did not receive one directly from us to fill it in . . . and return it to us . . .

"We are of the opinion that a closer contact between the studio and the theatre will result in an improvement in the quality of the product reaching the public . . ."

Here is the Academy questionnaire:

QUESTIONNAIRE

Studio-Theatre Coordination

1. Do you believe that a closer, more definite contact between theatre men and the studio technicians would result in general improvement in results as viewed and heard by theatre patrons?

——Yes ——No

2. Would you approve of the issuance and distribution of a series of informative bulletins outlining in a general way the technique of recording and photography, supplemented by our views as to how motion pictures may be presented to best advantage in the theatre?

——Yes ——No

3. Would you be interested in receiving such information?

——Yes ——No

4. Will you assist us to the extent of explaining just what type of information would be most helpful to you?

....

....

....

5. Advances are being made from time to time in recording and photography. As a theatre manager or projectionist, would you be interested in information which would help you to periodically modernize your equipment to take advantage of these developments, thereby improving the screening of your pictures?

——Yes ——No

6. Please give us any comments or suggestions which may occur to you in connection with the above.

....

....

....

In order that we may correspond with you further, if necessary, please sign the questionnaire and indicate the theatre with which you are connected.

Academy of M. P. Arts & Sciences
Suite 1219, Taft Building
Hollywood, Calif.

Capacitor Functions Cited in Aerovox Bulletin

THE usual capacitor—just plain "condenser" to you, but capacitor is a more explicit term—has three important and usable qualities, as follows:

1. The capacitor does not pass direct current but provides a path for alternating current, the impedance of which is inversely proportional to the capacity.

2. When used in A. C. circuits, the reactance can be expressed in equivalent ohms, and the reactance is inversely proportional to the frequency as well as inversely proportional to the capacity.

3. There is a phase difference of 90 degrees for a perfect capacitor, the current leading the voltage.

The various applications of capacitors, then, can be classified according to which one of the three qualities is being utilized. For instance, where a capacitor is employed as a coupling element in a resistance-coupled amplifier, it is the first property alone which makes it suitable for the purpose. The second and third are present, of course, but they are not desirable in this particular application.

The first group of applications—those utilizing property No. 1, include: coupling capacitors, by-pass capacitors across bias resistors or voltage dividers, and in plate, screen and grid circuits.

Group 2 applications, utilizing both property No. 1 and No. 2, include all those wherein frequency discrimination is desired. The common tone control and some forms of resistance-capacity filters are the examples.

Group 3 includes applications wherein all three of the above mentioned qualities are utilized, such as filters consisting of inductances and capacitors, and in tuned circuits, some of which are confined to fixed capacitors, for instance in tone compensating networks.

Specific circuit details, constants and formulae for the application of capacitors in the three broad groups referred to, appear in the April issue of the *Aerovox Research Worker*, available from the Aerovox Corp., Brooklyn, N. Y.

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Independent Dealers' Convention

MOST successful from the standpoint of attendance, number and variety of exhibits and work done was the recent Convention of the Independent Theatre Supply Dealers' Association held at the Edgewater Beach Hotel, Chicago, Ill., June 15-18. Thirty-six manufacturers displayed their wares in the East Lounge, in which the dealers gathered between business sessions, distinguished this year by spirited discussion of all problems relating to the supply business.

Following a brief business session, the Convention opened with an address by James J. Finn on "The Services Projectionists and Dealers Render to Each Other." This presentation was enlivened by some spirited discussion during which it developed through statements by several dealers that projectionists exert a potent influence upon the purchase of equipment. One case was cited wherein the recommendation of INTERNATIONAL PROJECTIONIST anent a certain equipment effectually blocked out the unit from many theatres.

Other addresses were made by Captain John Gorby on "How to Sell Goods Profitably to Maintain Exhibitor Good Will," and by E. S. Clifford on "Merchandising at a Profit Through the Printed Word." E. A. Williford of the National Carbon Co. also addressed the dealers.

The business sessions were closed to all but accredited delegates, but the joint manufacturers-dealers meeting, an open-forum discussion of problems of mutual interest, and the exhibit room enabled a full exchange of views between maker and distributor. President Joe E. Robin stressed the need for improvement in equipment, seating and other fixtures if the motion picture theatre is to survive, and he gave vigorous support to a plan for the establishment of a testing laboratory by means of which all dealers may be posted on the exact efficiencies and operating characteristics of equipments *before* they merchandise them.

Consideration was given to a greatly enlarged advertising and promotional campaign to better acquaint the industry with the services of the Independent dealer.

Officers elected for the ensuing year are: Ben Shearer, Seattle, president; K. R. Douglass, Boston, vice-president; Clem Rizzo, Philadelphia, treasurer; and J. E. Robin, New York, executive secretary. Robin will continue to direct activities of the organization from the executive offices in the Paramount Building, New York.

Among those present in Chicago were:

Dealer-Member Delegates

Paul Heuter, Toledo; F. R. Gardiner, Columbus, O.; Ralph Ruben, Detroit; I.

Attention

Repeated reasonable requests for essential operating data requested by I. P. readers have been ignored by The Cincinnati Time Recorder Co., makers of the so-called CTR theatre sound equipment. I. P. holds that there should be no "secrets" relative to any equipment intended to withstand the rigors of daily projection room operation.

In line with its recently announced policy of citing such manufacturers to the craft, I. P. states its opinion that craft approval of and cooperation with The Cincinnati Time Recorder Co. should be withheld until such time as this company complies with the aforementioned requests. I. P. disapproves of such policies and, naturally, of equipment sold thereunder.

"Mystery" equipments are unworthy of craft concern and should be kept at the factory for the individual experimentation and amusement of their manufacturer.

H. Moskowitz and J. J. Pear, New York; J. E. Maguire, Los Angeles; I. S. Perse, New York; K. R. and L. L. Foster, Boston; Herman R. Maier, New York; Clem Rizzo, Philadelphia.

Also J. H. and W. J. Katz, New York; A. E. Thiele, Des Moines, Ia.; J. F. and H. C. Dusman, Baltimore, Md.; William L. Odum and W. Z. Horvat, New York; Ray Colvin, St. Louis, Mo.; J. P. Filbert, Los Angeles; Joe Goldberg, Chicago.

Also H. W. and J. Graham, Denver, Colo.; J. Guercio and William Barthel, Chicago; J. C. Hornstein, New York; George McArthur, Detroit; E. E. Oliver, Cleveland; Walter G. Preddey, San Francisco; Carl White, Omaha, Neb.; Miss V. Harwell, Birmingham, Ala.

Also O. J. Hazen, Salt Lake City; B. F. Shearer, Seattle, Wash.; Homer Tegtmeier, San Francisco; Guy Slipper, Los Angeles; A. Mortenson, Houston, Tex.; C. H. Badger, Kansas City, Mo.; A. F. Morrone, Pittsburgh; Ray Smith, Milwaukee; F. A. VanHusan, Omaha, Neb.; G. W. Linden, Buffalo; C. A. Paden, San Francisco.

At Manufacturers' Exhibits

Mrs. Mary Ashcraft, Ashcraft Mfg. Corp., Los Angeles; George A. Schook, Baldor Electric Co., St. Louis; Karl Brenkert, Brenkert Light Projection Co., Detroit; D. A. Wilczek, Carbon Products, Inc., New York; J. S. Meek, Clough Brengle Co., Chicago.

C. H. Roessener, Da-Lite Screen Corp., Chicago; W. C. DeVry, Herman A. DeVry, Inc., Chicago; W. H. Hirschfield, Enterprise Optical Co., Chicago; J. Elderkin, Forest Electric Co., Belleville, N. J.; E. Oak, General Electric Supply Co., Bridgeport, Conn.

M. H. Goldberg, Goldberg Bros., Denver, Colo.; J. E. Robin, Imperial Electric Co., Akron, O.; Mrs. Reuschle, LeRoy Sound Equipment Co., Rochester, N. Y.; O. F. Neu, Neumade Products Corp., New York; W. C. Kunzman, National Carbon Co., Cleveland.

M. F. Klicpera, Operadio Manufacturing Co., St. Charles, Ill.; A. G. Gardner, Platter Sound Products Corp., North Vernon, Ind.; H. Chaplin, Projector Improvement Co., New York; A. L. Raven, Raven Screen Co., New York; M. Harris, RCA Mfg. Co., Camden, N. J.; Harry H. Strong, Strong Electric Co., Toledo; H. J. Maul, Weber Machine Co., Rochester, N. Y.; M. Wenzel, Wenzel Co., Chicago.

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I. A. Hits I. B. E. W.

From I. A. Bulletin

NOT content with the piracy of our jurisdictional lines, which won for them the utter contempt of every loyal member of Organized Labor, and the memory of which is still both ripe and bitter in the hearts of each and every member of the Alliance, the Electrical Workers' organization is once more on a marauding crusade. The intent and purpose of the second attempt is precisely similar to the first—invasion of our jurisdictional rights—accomplished when they threw aside their cloak of Unionism and donned the garments of the "scab."

This most recent venture differs only in manner, the I. B. E. W. resorting to legislative measures to further add to their ill-gotten spoils. The endeavor is an abrogation of the jurisdictional rights maintained by our International for many decades and recognized by Organized Labor.

Enactment of the bills proposed would seriously menace our organization, creating hazards highly detrimental to our interests, and is in direct conflict with the principles, policies and spirit of Organized Labor as promulgated by the A. F. of L. In effect it transfers our jurisdictional powers to the I. B. E. W.

These bills have sprung up with carefully designed precision in various parts of the country and, while differing slightly in context, universally embody parallel provisions — a monopoly of every nature of electrical work.

The Electrical Workers' ambitions, if confined to the already extensive territory controlled by that organization, would be serving both a worthy and honorable cause. Were they to organize all those varied parts of the country which are unorganized there wouldn't be sufficient electricians to fill the jobs in the nation. Unfortunately, they are striving to "move in" on jurisdiction that has been built up and maintained by our Alliance only after years of sacrifice and effort.

To assume a careless and indifferent attitude at this time would be paramount to issuing an invitation to make a wholesale raid on the industrial lines which we have striven so mightily to attain. Thus far the opposition offered by our organizations has proven that our membership is alive to the seriousness of such an eventuality.

Each member of the Alliance should voluntarily assume the role of a sentinel and selfishly guard against these enemies of our organization, who have become so bold as to openly strive to secure the condition described. This ceaseless plundering of our International endangers its very existence, the portents of which must be forcibly brought home to each member carrying a card in our Alliance. . . .

General 2% Assessment to Raise Million Highlights I. A. Board Meeting

APPROVAL of a special 2% assessment to be levied on all working members irrespective of classification highlighted the deliberations of the I. A. T. S. E. Executive Board in St. Louis the week of June 17. The assessment will become effective July 15, with the responsibility for collection and forwarding to the General Office to rest with each Local unit.

The recent voiding of the NRA by the U. S. Supreme Court was held by the Board to have placed the I. A. in a "precarious position" throughout the country, and this, coupled with other factors which were discussed at length, prompted the levying of the assessment. No time limit other than that indicated by setting a million dollars as the goal of the defense fund was set. Action of the Board on this proposal was unanimous.

Considered by the Board as "absolutely essential" to the welfare of the organization, the defense fund will be utilized to effect a general "tightening up" of the Alliance organization nationally. Working conditions in many sections were held to be highly unsatisfactory, with altogether too much latitude being allowed non-members. Just what part recent legislative activities by the I. B. E. W. and the sound equipment servicing situation played in inducing the assessment was not indicated, although it is known that both these topics were discussed at length.

The St. Louis meeting was the first of four to six such sessions to be held in various key cities, in line with the plan of the Board to break away from the routine heretofore followed in gathering in the city where the General Office is located.

Other business transacted by the Board included a decision to maintain I. A. control over Local 306 for an indefinite period, the New York situation still being badly muddled as a result of the existence of two unions other than Local 306, and the constant warfare between opposing factions in the latter unit. No announcement was forthcoming relative to the immediate future status of Chicago Local 110, also under I. A. control.

It was also voted to rescind the recent ruling whereby Local 306 members were put on a four-day week as a relief measure for the 300 unemployed members. With the bulk of the membership returning to a five-day week, which proposition has figured in court proceedings against the I. A., the unemployed will be paid $18 each weekly from a fund raised by a special assessment against the working members.

Rioting marked the resumption recently of picketing operations by all N. Y. City unions. In an effort to bring some semblance of order to a chaotic situation, Mayor F. H. LaGuardia appointed Frank Tichenor, publisher of *Outlook* magazine, as mediator. More than 125 pickets have been arrested within the past three weeks.

Studio soundmen have been authorized by the I. B. E. W. to organize an autonomous unit of their own apart from the regular Electrical Workers studio group. The soundmen will participate in conferences on a renewal of the studio pact.

Effective July 22 there will be imposed a 4% State admission tax on all Pennsylvania theatres. Designed to raise five million dollars over a two-year period, the law also requires exhibitors to take out a $1 yearly permit. Unions fought the tax bitterly in cooperation with exhibitors.

Line voltage fluctuation is so pronounced here that we are thinking of constructing a good voltage control outfit. Our 110-volt line differs plus or minus 8 volts. In our May issue (page 7) appeared a very clear and concise Circuit Control Analysis, and the men have been asking for more data on how to build the 308-transformer used in this outfit. Please supply data on this or any other voltage control apparatus that can be built by the men themselves.

N. J. N., Penna

Line Voltage Regulation

By LEROY CHADBOURNE

THERE are many communities, both large and small, in which the 110-volt line varies as much as plus or minus 20 volts. Having received numerous complaints on this score from widely scattered localities, I. P. feels that this topic deserves detailed treatment. With all the improvements that have been made in sound projection, line voltage control still is very much where it was in 1928.

Unfortunately, the winding of a transformer "by the men themselves" will seldom prove practicable. The procedure involved, and the objections thereto, are discussed in detail further on. However, the question of line voltage control is much broader than a mere matter of transformer design, thus it should prove beneficial if we took a bird's-eye view of the topic overall before considering a single detail.

For one thing, the trouble that can result from bad line regulation is so extensive and so serious that it would seem unnecesary for any projectionist to bother to wind his own transformers. The theatre management will unquestionably be willing to pay for proper protective equipment *if* they are thoroughly informed of the real danger of the condition, and how much actual damage and expense can arise therefrom.

Regulation Troubles

I. P. for November, 1934 (page 14) describes the troubles that bad regulation can cause in amplifiers alone. These may be summarized briefly as follows:

Tubes. High voltage shortens the life of a tube filament. Whether the filament burns out or not, its life-period of useful emission will be decidedly abbreviated. This applies to both rectifier and amplifier tubes.

Insulation. Cotton-and-wax types of insulation are destroyed, the wax slowly evaporating, leaving the cotton to char. Rubber insulation deteriorates, and may crack and expose naked wire. Both conditions result from the overheating consequent upon excesive voltage. Overheating also thins insulating tar or creosote compounds, causing them to leak, drip or bubble from the condensers, transformers or coils they are intended to protect. All these conditions lead to a short-circuit that may do extensive injury.

Condensers. High voltage may puncture a condenser, destroying it, while the resulting short-circuit may destroy such associated apparatus as transformers, choke coils and tubes. Loss of insulating compounds, as described above, may also lead to such short-circuit, or may result merely in a loss of capacitance causing hum or howl in the sound.

Resistors. Resistors may be burnt out by high voltage. Excessive heat may break, shrink or warp the frames of rheostats, causing noise in the sound whenever the instrument is adjusted. Warping may be so severe as to lock the rheostat arm in one place, making adjustment impossible.

Coils. Transformers and other coils may burn out—a condition that can tie up the show for a long time, since such spares are seldom carried in stock and cannot always be obtained promptly.

Sound Quality. Excessive grid and plate voltages tend to cause overloading and distortion. In a self-biased amplifier (one not using C batteries) low line voltage may cause distortion by lowering the grid bias. Low line voltage may also make it impossible to secure enough volume for a full audience. The early evening hours, when a theatre is most crowded, coincide with the period of peak load when poorly regulated lines are at minimum potential.

Now the foregoing refers to amplifiers *only*. Most of the troubles listed, however, apply with equal force to rectifier power units which also contain tubes, insulation, condensers, resistors, transformers and choke coils. These are only minor differences. Loss of capacitance in a rectifier condenser, for example, cannot create howling in the sound, but it can nevertheless cause hum.

Speakers. Most speakers receive their field excitation either directly or indirectly from the 110-volt line. High line voltage can consequently burn out the speaker field. Low line voltage means that the field is not creating the full magnetic flux for which it was intended, and therefore to produce an equal volume of sound a larger current must be driven through the speech winding. This condition, if prolonged, may burn out the speech coil. That coil rides with the vibrating diaphragm, and is made of light, thin wire in order that the diaphragm may not have to move an appreciable weight of copper.

Motors. In some cases bad line regulation may injure projector drive motors, since they cannot increase their speed to accommodate an increase in applied voltage. Fortunately, this condition is not common.

Checking Line Regulation

The first necessary step in eliminating these dangers is to determine exactly how bad the regulation is. Treatment and equipment adequate to a variation between 102 and 118 volts might be wholly useless in theatres where the range is from 90 to 135.

The only thorough way of checking a power line is by means of a recording

Discuss I. P. Articles

Editor, I. P.

You ask for suggestions about articles to appear in I. P. Our suggestion is to include articles that could be used for debate and discussion. This doesn't necessarily mean that you should carry a full story of any given topic, but rather print an outline to which could be appended the titles of books or other reference sources to which the boys could refer prior to the discussion. Then everybody could come to the meeting "loaded for bear," and a lively discussion should result.

We have been following this procedure for some time, and we are now considering the article on Aluminum Reflectors which you printed recently[1].

JOHN K. DEYARMON
Local 576 Mansfield, Ohio

[1] "Aluminum Reflecting Surfaces for Projection Work," by J. D. Edwards, February, 1935. p. 15.

voltmeter. Most power companies will lend this instrument without charge.

The meter carries a replaceable paper disc, good for one week. The indicating member is a pen, which rests on the disc. The paper revolves slowly under the pen, completing a full revolution in one week's time, and recording every rise and fall of voltage during that period. The paper is then removed and kept for purposes of record, and any regulating equipment that may be required is chosen according to the maximum and minimum potentials shown. This meter is very simply installed, being merely clipped across the line, ahead of all switches, so that it will operate continuously.

In a few communities the power company may make difficulty about supplying a recording meter gratis. This is sometimes the case where regulation is unusually bad. In such instances readings may be taken with an ordinary a.c. voltmeter at ten-minute intervals, and carefully noted. This is an unsatisfactory substitute method thay may fail to catch short peaks of exceptionally poor regulation, and is of course far more troublesome.

Determining Regulator Load

After the condition of the line is known, it still is necessary to determine the load, in amperes or watts, that a regulating device must govern. For this purpose list all the apparatus that will be powered through the regulator. Such apparatus will normally include all amplifiers and sound-power-supply rectifiers. In exceptional cases, where the voltage occasionally becomes very high and projector drive motors or sound-supply motor-generators are observed to overheat beyond their rated rise in temperature, motor equipment also may be included in the protection. Add the power requirements of all protected apparatus to determine the power requirement of the regulator.

The drain of each piece of equipment may be found on the nameplate. When not given there, it is sometimes shown in the instruction sheet or book furnished by the manufacturer; or it may be obtained by direct reading with a wattmeter or ammeter. If necessary, write to the manufacturer, or to this publication, giving all information necessary to identify the apparatus.

There are two general types of regulators; those that use transformers and those using rheostats. The former are usually more economical of current, since use of a rheostat will involve power loss, while a good transformer is more than 90% efficient. The rheostat type, on the other hand, is likely to have a lower first cost.

The simplest transformer regulator consists of an instrument with a tapped primary or a tapped secondary. By changing the tap connections the turns ratio between primary and secondary is altered, and the output voltage is held constant in spite of variations in the line.

Many sound amplifiers and rectifiers are built with power transformers so tapped. But they are seldom built with switches by which the tap connections can be changed in the course of the show. Nor is it very practical to try to adjust half a dozen different units each time the line fluctuates. The tapped transformers in such equipment are intended to be set, during installation, for *average* line conditions.

All sound units needing protection may he powered through a larger transformer, similarly tapped, and provided with a tap switch. The difficulty here lies in the relatively heavy current that must be interrupted each time the switch is re-set, with possible arcing, noise in the sound, damage to the switch points, and, conceivably, unsafe surges of current through the apparatus supplied. With switching arrangements suitable to the nature of the work, such a transformer constitutes a satisfactory regulator.

The W. E. 308-A transformer (Page 7, I. P. for May, '35) is used differently. It handles little power, and its switching arrangements are therefore unlikely to give trouble. Its secondary is in series, its primary in parallel, with the line to be regulated. By use of a polarity—reversing switch in the primary circuit, the 5 or 10 volts generated in the secondary can be made to oppose or reinforce the line, as desired. A second switch in the primary circuit places the two primary coils either in series or in parallel with each other, and thus determines whether the secondary potential shall be 5 volts or 10.

Rheostat-Type Regulators

The rheostat-type regulator can be used in many theatres with complete satisfaction. It will not cure low voltage, but low voltage that is not extreme can be tolerated. The rheostat regulator can probably be used if the figures given (plus or minus 8 volts) represent the extreme maximum and minimum. How to calculate a rheostat for this purpose is explained further on. Although our correspondent does not mention what type system he has, it is doubtful that a minimum of 102 volts will cause serious loss of volume, distortion due to low grid bias, or any of the other troubles that arise from the really low voltages often met with, such as 90 or 85.

The power loss involved in a maximum drop of 8 volts through the rheostat is likewise not serious. Assuming that our correspondent has a medium-size installation, the current should not be more than 5 amperes, which comes to a maximum loss of 40 watts occurring only when the line potential is at its highest peak. In theatres where the current to be controlled is larger, and the line voltage runs perhaps to 135, the loss will be much more important.

A series-rheostat regulator of course includes means to "short" the resistance out of circuit when the line falls below 110.

Rheostat and transformer regulators may be combined in a single unit. The transformer is designed to raise the voltage to 110, from whatever the recording voltmeter may have shown to be the line minimum. When the line is at minimum voltage, the rheostat is shorted out of action; at all other line voltages the transformer output will be higher than 110 and the rheostat takes up the difference.

Selection of Regulators

Since complete voltage regulating units are commercially available, the desirability of building such equipment in the projection room is, at best, questionable.

The rheostat-type is the easier to build. The simplest way is to buy a rheostat

Power Requirements of Common Equipment Units

Erpi Amplifiers Type	Wattage	RCA Amplifiers Type	Wattage
25 C	40	PG 30 Rack	800
32 A	40	PG 31 Rack	1,020
34 A & B	40	PG 32 Rack	800
42 A	80	PG 59 Rack	300
43 A	300	PG 59 Monitor Amplifier	50
46 A, B, C, E & F	80	PG 65 Rack	500
A-46 C, E & F	80	PG 65 Monitor Amplifier	50
51 A	40	Economy Model Amplifier	270

Erpi Rectifier Sound Power Units

Type	Wattage	Type	Wattage
TA 4033 & TA 4033 A	280	TA 4038	250
TA 4035 & TA 4035 A	720	TA 4144	500
TA 4036 & TA 4036 A	330	TA 7276	530

of proper specifications, a suitable metal cabinet, wire, switches, voltmeter and binding posts. But it will likely prove just as cheap to buy the finished assembly, even without taking into account the time and work put into the home-made job or the chance that the results may through some error prove unsatisfactory. Whereas if the bought control cabinet should prove unsatisfactory redress can be had against the manufacturer.

If the complete cabinet is bought, all that is necessary is to specify the load in amperes to be carried and the extreme voltage range to be covered.

The principles on which a rheostat is chosen are explained in detail in I. P. for May, 1934 (page 5). Briefly, the instrument must be capable of carrying the current required by the apparatus to be protected, and its resistance in ohms, multiplied by that current, must equal the voltage drop needed. The resistance obtained when the rheostat arm is set at the middle tap or position should be that which is needed under average conditions. The maximum and minimum resistances obtainable should be those that correspond to the maximum and minimum voltages shown by the recording meter.

The case our correspondent furnishes is an excellent example. Assume the current he needs to be 6 amperes, the voltage drop required of the rheostat having been stated as 8 volts. Then what maximum resistance multiplied by 6 amperes will give a drop of 8 volts?—or, in Ohm's Law, R x 6 = 8; R = 8/6; R = 1 1-3 ohms. Regulation will be very satisfactory if this rheostat is tapped at 2-volt intervals, which is the same as saying at 1-3, or 2-3, and 1 and 1 1-3 ohms, with a short-circuiting tap, cutting the rheostat out of the line, beyond the 1-3-ohm setting.

Transformer-Type Regulators

Although it may be conceivable that in some cases building a rheostat-type regulator will be preferable to buying one ready built, no one would bother to buy resistance wire, an insulating form, and other parts for the purpose of building a rheostat. The finished rheostat is not only more likely to prove reliable, but cheaper, because the rheostat manufacturer can buy or make such parts at far less cost than could the projectionist.

The same considerations apply with greater force to winding one's own transformer, a much more difficult instrument to make.

Silicon steel, of which core laminations are made, is very hard material to work, and its magnetic characteristics are impaired if it is worked after annealing. For practical purposes it is usually bought cut and punched to specification. Consequently it is expensive in retail quantities. Each lamination must then be shellacked, unless the manufacturer has had them on hand, after annealing, long enough for them to form a coating of rust which serves as sufficient insulation.

A three-sided square is built up, the laminations being interleaved at each corner. The coils are wound of the proper size wire with the proper number of turns, impregnated paper insulation being used between each layer to keep the upper wires from slipping into the lower layers and forcing them apart. Next comes the somewhat tricky operation of slipping each coil off its winding form and over a leg of the core without allowing it to lose its shape (a wrapping of impregnated paper having been placed over the core leg to prevent grounds). The laminations constituting the fourth side of the core are then interleaved with those of the other three sides, and the whole is bolted together and dipped in insulating compound. After this, binding posts for connections and suitable feet or angles for mounting to a panel are added, and the job is done.

Unit Purchase Preferable

Now the cost of core material, wire, insulating compound, impregnated paper and so on, bought at retail, is likely to run somewhat higher than the cost of a finished transformer, ignoring the question of time and labor involved, or the possibilities of an internal "short" or other defective workmanship in the product of an amateur.

It is also unlikely that anything can be saved by buying a proper transformer, cabinet, voltmeter and other parts, and assembling them, as against asking a transformer manufacturer or other supplier to furnish a complete unit.

Furthermore, all equipment used in the projection room must comply with underwriters' rules and all local regulations, which may or may not constitute an additional source of headache.

I. P. holds that there can be no good reason for the projectionist undertaking responsibilities so foreign to his proper work. In view of the very serious and expensive troubles than can be caused by uncontrolled line variations, it is incredible that any exhibitor will hesitate at the moderate cost of control equipment, if the need for it be properly presented.

Origin of the 'Motions'

Centuries before the Christian era, even the Chinese had a yen for pictures that move, and cut moveable figures, operated by strings, to be shown through a screen, out of donkey skins and cowhide. The Turks, averse to pictures generally as being sacrilegious, went in for movies, too, and even the Javanese had the same kind of moving pictures, so it would seem that through the whole childhood of the race the world has cherished the wish to entertain itself through this medium.

Even the name isn't new, for back in 1616, in the first edition of Ben Jonson's collected works, he mentions a lady friend who admitted that her most cherished form of entertainment was "attending the motions."

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Summer Plagues	Cause	Prevention	Emergency First-Aid
Sunburn	Over-exposure of skin to sunlight.	Avoid exposure for long intervals, acquire tan gradually.	Soothing applications Carbolated petrolatum, plain vaseline, 3 parts olive oil, 1 part lime water.
Heat Exhaustion (associated with symptoms of shock and circulatory failure).	Excessive heat and humidity.	Avoid direct sunlight and over-exertion during period of excessive temperature and humidity.	Send for doctor at once. Remove to cool, well-ventilated place. Keep body warm and give stimulants and hot applications. Keep head low.
Sunstroke (associated with pain in head and unconsciousness).	Excessive heat and humidity	Avoid direct sunlight and over-exertion during period of excessive temperature and humidity	Send for doctor at once. Remove to cool place, remove clothing and give cold applications or cold bath. Avoid stimulants.
Blisters.	Pinching, chafing or irritation of skin.	Avoid over-irritation of skin as in tennis, rowing (hands), and walking or climbing (heels).	Apply small amount of iodine over blister and puncture carefully with sterilized needle. Apply vaseline and dressing.
Ivy Poisoning.	Irritation of skin by a resinous substance in the sap of poison ivy.	Become acquainted with the three-leafed poison ivy plant and learn to avoid it. Free use of alkaline soap and water. Washing must be prompt and thorough without harsh scrubbing. Alcohol or gasoline may be used, but avoid danger of fire and use of lead gasoline.	Free use of alkaline soap and water (strong laundry soap is best) made into thick paste and applied over rash. Weak (5%) solution of permanganate of potash may be applied. Consult your doctor.
Insect Bites and Stings.	Various insects.	Avoid and eliminate insects through cleanliness, sanitary measures and screening.	Application of a paste made of baking soda or a compress moistened in ammonia water. Beware of infected bites.

★ Smothering Opposition via the Educational Route

By JAMES J. FINN

NOT so many years ago educational sessions were a regular occurrence within scores of projectionist organizations, meetings usually being held at midnight or, as when sound pictures were introduced, in the morning before theatre opening time. Recent years have witnessed a cessation of these extremely vital activities in most locations, and in several towns which previously had boasted of fine records in this respect such sessions came to an abrupt halt.

The reason for this slackening of interest in educational work is not hard to find: this industry was not spared the effects of the economic disaster which was ushered in in 1929, and the men became increasingly worried about their economic security and speedily lost their earlier enthusiasm for classwork. Nor was this feeling confined to projectionists, for there was no industry that was deeper in the economic doldrums than that of motion pictures.

A decided improvement in this situation is reflected in advices reaching I. P. from every section of the country. As of old, there is a steadily increasing flow of letters which with that well-known pride point to this, that and the other educational activity of various organizations. The latest word from the field is that the argumentative bent of projectionists, although stilled for several years, has never really been snuffed out. The arm-wavers and those blessed with strong voices are reported to be more agile and more vociferous than ever.

All of which is all to the good, and all of which has long been a pet recommendation of this publication. As has often been pointed out herein, wages and conditions are better and craft conflict conspicuously lacking in those locations where there exists an alive and alert organization which has continually hammered home the idea that better craftsmanship and better equipment make for better work and better pay.

After all, if an exhibitor is enabled to produce just as good a picture on his screen with an anybody dragged in from the handiest street car or subway or truck or shipping department, the chances are 1000-to-1 that he will elect to take that anybody and pay him wages befitting a common day-laborer.

By Way of Example

Let's consider the amazing success attendant upon the educational work done by Buffalo Local Union 233 during the past Winter—not merely because it is Buffalo but because this is one city of which the writer has personal knowledge and is damned expressive of what great good can be done with a little planning and a bit of hard work by a couple of unselfish members of any organization.

This flow of words was induced by the receipt recently of a letter from George H. Signor who heads the Local 233 educational society and to whom must go the lion's share of credit for the really magnificent results attained during the past season Describing a typical meeting, he writes:

"There were 86 men present: 53 of our own boys, 6 from Rochester, 9 from Niagara Falls, and 1 from Batavia; from Canada there were 4 from St. Catherine's, 2 from Niagara Falls, and 4 from Hamilton. All of these visitors were highly pleased with the lecture.

"At our other meetings through the season we had Karl Brenkert, who discussed and domenstrated arc lamps and showed some fine slides; Allan A. Cook from Bausch & Lomb Co., who talked on lenses, reflectors and condensers; Messrs. Cunningham and Moyer of Eastman Kodak, who lectured on film and the Kodacolor process; Messrs. Geib and Joy of National Carbon Co., who covered the topic of carbons thoroughly.

"Also, we had a fine presentation on accoustics by Dr. Darrow of Erpi; James J. Finn, editor of I. P., gave a straight-from-the-shoulder talk on the necessity for projectionists knowing their business thoroughly; generators were covered splendidly by C. C. Dash of the Hertner Co., and one of our own men, Harold Potter, lectured on amplifiers and used an oscilloscope to show just what was happening in the process.

"For the final session we were privileged to have John Krulish and P. A. Mc-

This is the way they do it in Buffalo. "School" opens with the old feed bag, immediately following which the session begins. In the background are International Projector Corp. representatives who did all the work on this occasion.

Guire of International Projector Corp., and our group was thoroughly "overruled" on mechanisms in general and on the various parts. Coincidently, a few days after Mr. Krulish's talk I was called upon by an outlying theatre to make a projector adjustment. The projectionist had taken out the lateral guide rollers, but not having heard our lecture, he had disturbed the adjusting collar. In taking them apart to clean he had stretched the spring, after which he projected a picture that was unsteady sidewise, with the film slipping out from between the rollers and curling on one side between the roller and the film trap gate.

"Here is an object lesson of the value of our educational work. This very point had been stressed at the lecture only a few nights previous, and everybody attending was forewarned on it. This incident can be multiplied hundreds of times on a variety of sound and projection items.

"The foregoing is quite an ambitious program for one season, and next year we'll all be back for more."

To which may be appended a fervent Amen. Not that Buffalo stands alone in this respect. Such big cities as Cleveland, San Francisco, New York (before it became the projection shambles it is today), and St. Louis all put the pressure on educational activities. And in every one of these cities were men who knew their business thoroughly and who could pin back the ears of some of these alleged projection experts on any discussion of theory, practice or equipment.

The purpose of this meager and rather ineffectual grouping of words is obvious: they are meant to drive home the message (1) that not all projectionists are "wise guys" in the sense that they know it all; (2) that there exists a great need for the continuation and expansion of such educational activities by units of the organized craft; and (3) that the job of organizing and furthering such

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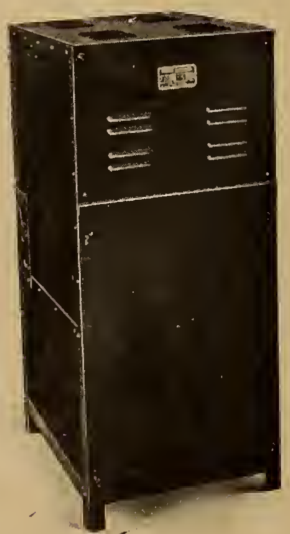

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a program in a given locality is not impossible provided there be a couple of men who realize that their security lies in their knowledge of projection, their ability to translate this knowledge in terms of practice—by which is meant results on the screen—and who possess sufficient regard for the organization that makes it possible for them to make a living to go out and contribute something to, rather than take from, that organization.

The mark of a really good man is that he demands good equipment; but if he be a technical dullard, he knows not the difference between good or bad. The writer rises to inquire, for example, as to where in this country was there an owner or manager who knew his ear from his elbow about the Suprex lamps? The answer is: nowhere. But Mr. Projectionist knew, because he had applied himself either to a magazine or a book or even to a catalog; and practically every Suprex lamp that is operating today is in that old projection room just because Mr. Projectionist knew. And so it goes right down the line on all items of equipment.

Summed up, if Joe Doaks, or Mickey Mope, or John Doe or whoever he may be can come from the truck, the street car, the subway, or the pick and shovel gang—knowing not the difference between a sprocket and a vacuum tube—if such men can walk in and proceed to do "just as good" as the man who belongs to an organization and is representative of that organization, then we all might just as well shut up shop, lock the door and throw the key away

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MOVIE PROJECTOR DEVELOPMENT

(*Continued from page* 11)

exhibitions do, the feature of relatively long periods of rest and illumination of each picture on the film.

I personally operated the machine the first night. All the scenes shown, with one exception, were what might be called vaudeville turns, or stage subjects. A crowded audience applauded each of the scenes with great enthusiasm. The one exception to the stage scenes was an outdoor scene that Raff and Gammon had succeeded in getting from Robert Paul, who by that date was experimenting with motion pictures in England. This scene was of storm-tossed waves breaking over a pier on the beach at Dover, England—a scene that was totally unlike anything an audience had ever before seen in a theater. When it was thrown upon the screen the house went wild; there were calls from all over the theatre for "Edison," "Edison," "speech," "speech."

A graphic account of the exhibition was published in the New York *Herald* of May 3, 1896, and previously to that date, on April 4 the New York *Journal* and the New York *World* published long accounts of the exhibition that I had given at the Edison Works.

It should be here stated that, by mutual agreement, it was decided that Edison's name should be used in connection with the machine. This was done partly for the commercial advantage of the prestige of his name and partly because he was the producer of and had patents pending covering the films, an essential part of the machine, that he was to supply. Prior to this, when I had gotten the machine in all its details into what I considered practicable commercial shape, I applied for a patent on it on February 19, 1896 and selected *Vitascope* as a name for the machine. This name was applied to a projection machine for the first time in this patent application, and it would seem that I added a word to the English language as the word *Vitascope* now appears in most modern dictionaries. The Vitascope, Edison Vitascope, so-called, made an immediate hit and was in great demand.

Subsequently I invented and patented another projection machine with a greatly superior intermittent movement. This machine is shown in my patent No. 578,185 filed September 25, 1896, issued March 2, 1897. This intermittent movement is known as the "Star Wheel" or Geneva Cross movement, and it superseded all others by 1897 and is in use today in practically every motion picture theater the world over. It was not, however, a part of the Raff and Gammon arrangement, being a somewhat later development.

The intermittent movement has been called, appropriately I think, the "heart" of the motion picture projection machine. In the early days this intermittent movement of my patent No. 578,185 was used in the Edison Projectorscope, the Powers Cameragraph, the Vitagraph, the Lubin machine, the Baird machine, the Simplex machine, and many other early machines.

(To Be Continued)

Bloom is Erpi President

Edgar S. Bloom has been named president of Electrical Research Products, Inc., succeeding John E. Otterson, who resigned to become president of Paramount. Mr. Bloom, who is also president of Western Electric Co., of which Erpi is a subsidiary, has been a director of the latter organization since 1928. No change in Erpi policies is anticipated.

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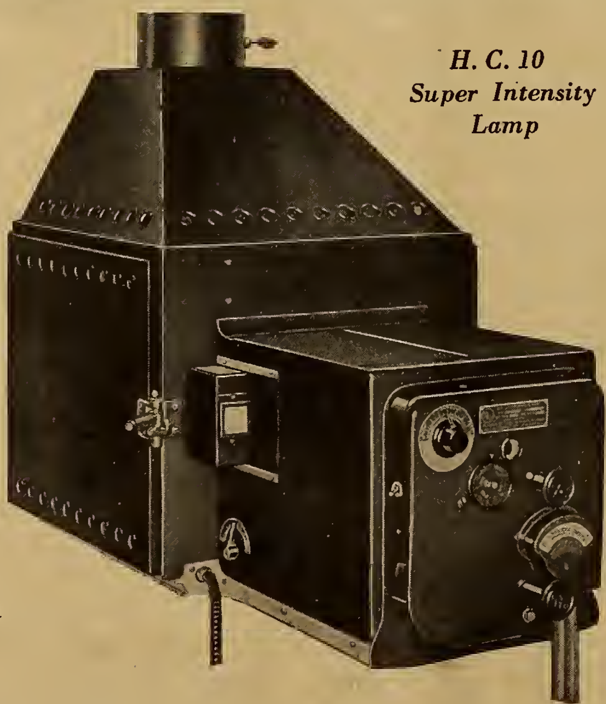

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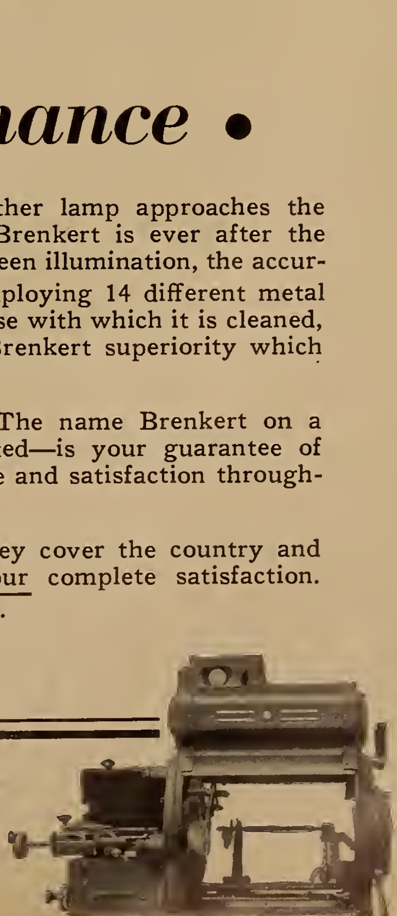

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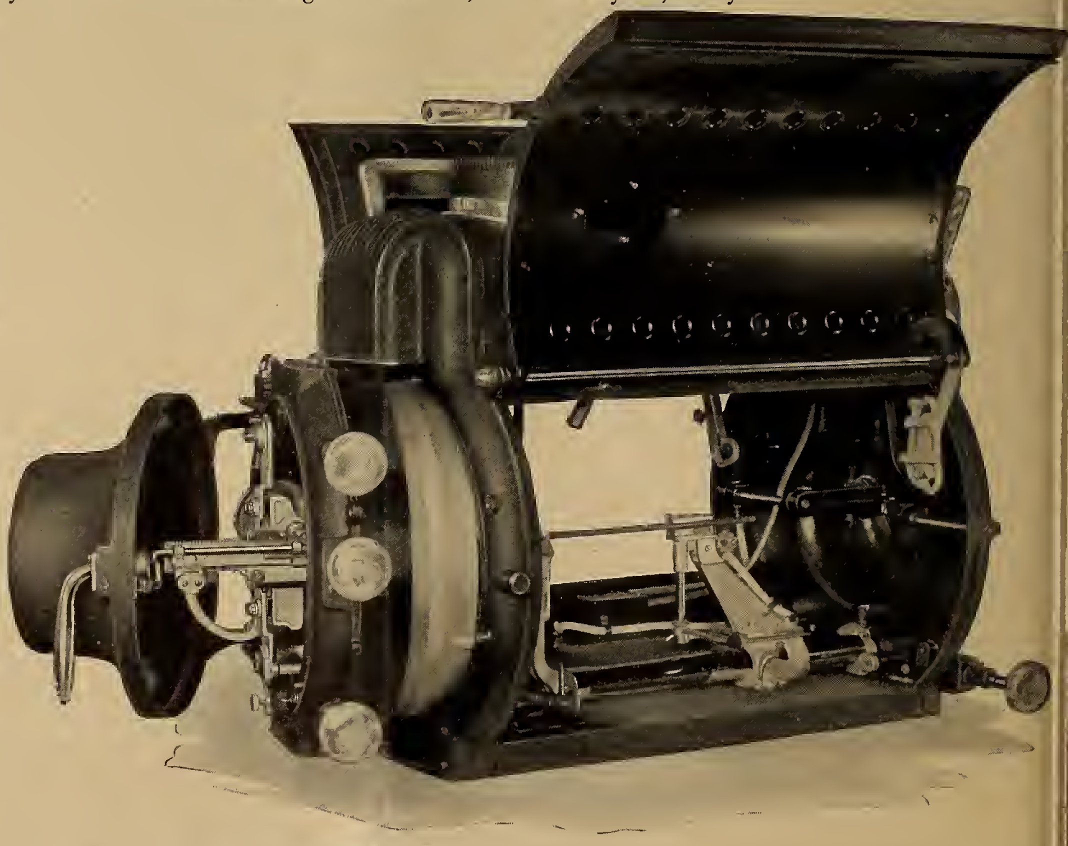

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Volume 9 JULY 1935 *No. 1*

Index and Monthly Chat 5

Mid-Summer Musings Upon Color, Sound System Profits, Television and Sundry Other Items 7
JAMES J. FINN

C-O Rectifier Aging 9

Step-by-Step Analysis of Sound Reproducing Equipment, XII 10
AARON NADELL

Development of the Motion Picture Projector, II 12
THOMAS ARMAT

The W. E. 705-A Control Cabinet 13
AARON NADELL

Academy Submits 2000-Foot Reel as Industry Standard 16

Theatre Reproduction and Color Feature S.M.P.E. Progress Report 18

Trouble Charts Enable Quick Equipment Repairs 19
A. C. SCHROEDER

News of the Month 21

News Notes
Technical Hints
Miscellaneous Items

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420

MONTHLY CHAT

SEVERAL recent deaths resulting from projection room fires should serve as a grim reminder that the projection process still is a few miles removed from absolute safety. Every reel of film contains all the ingredients necessary for tragedy, which is a good thing to remember when handling it. It seems unnecessary to point out that the projectionist is first in line to get it in such situations.

Handle every reel as though your life depended on the degree of care exercised—which in fact it does. True, many projectionists have escaped from burning projection rooms without harm, but there are a few fellows still alive today—with their skins peeled and the linings of their lungs missing—who wish they weren't. Take it easy.

MONTHS ago we predicted in this corner that the present amperage levels of the Suprex arc would be given a healthy boost within a year or so. Indications are not lacking that this upward tilt will occur before another year rolls around. It's the old, old story of being dissatisfied with that which we have. More light will require larger carbons and higher amperages, which means that the cost factor will be of prime importance.

INCIDENTALLY, the bang-up job done by I. P. on the Suprex arc development is emphasized by the fact that current issues of other semi-technical papers in the industry are just now getting around to presenting factual data on Suprex. I. P. popped this subject late in 1933 and since then has consistently chased the topic right down the line. Don't mention it.

THE hocus-pocus mob of producer and distributor fiends still are laboring over a concoction which they entitle "A Voluntary NRA." Labor's participation therein would be suicidal, if only on the score of the compulsory arbitration clause which is certain to be included.

DOUBLE reels as an industry standard, a project which seemed to have been permanently sidetracked, has been the subject of a beautiful Academy job, described herein. Slated to become official by Jan. 1 next, these reels will serve to cut expenses and make for better projection. Objections thereto are already on file and will be renewed; but it seems to us that the craft is seven or more years late on this angle.

Double reels have been discussed and promised for years and years, and the craft at large was strangely apathetic to the whole procedure. Now is the time to take the proposed standard and like it.

BIG NEWS

WITHOUT a doubt Super X Panchromatic Negative is the big news of the year as far as raw film is concerned. Its unprecedented speed . . . its fine grain . . . the improved photographic quality cameramen are getting with it under greatly varying working conditions . . . these factors point to Super X as 1935's major film advance. Eastman Kodak Company, Rochester, N. Y. (J. E. Brulatour, Inc., Distributors, New York, Chicago, Hollywood.)

EASTMAN *SUPER X*

PANCHROMATIC NEGATIVE

INTERNATIONAL PROJECTIONIST

VOLUME IX NUMBER 1

JULY 1935

Mid-Summer Musings Upon Color

Sound System Profits, Television and Sundry Other Items

By JAMES J. FINN

★ ★

The weather hardly being conducive to brow-puckering and concentration on involved technical articles, and the editor having succumbed to a seasonal lassitude that invites reminiscent dreaming of bygone events, there are offered herewith a few mental meanderings on topics which are deserving of convenient consideration by the craft.

★ ★

THERE have been sufficient runs of "Becky Sharp" throughout the country to enable a reasoned appraisal of the significance of this first all-color feature picture to the motion picture industry. Admittedly, Technicolor involves no serious reproduction problems, yet the craft is tremendously interested in the general overall effect of color upon the industry from which it derives its payroll dollars.

The highest hurdle confronting color films at present is an economic one, ignoring for the moment other problems which likely will succumb to the ingenuity and skill of the technicians, who thus far have exhibited some marvelous sleight-of-hand in licking numerous tough production problems.

But what about the economics of color films? Black-and-white prints cost 1.8 cents per foot. Technicolor costs 5.8 cents per foot; which leaves a balance favorable to the former process of 4 cents per foot. A little multiplication of 4 cents times the number of feet in a feature, times the number of prints in circulation, makes for a tidy sum of money on each release. Furthermore, a Technicolor feature requires the services of color specialists for plotting the composition of each scene, including the costumes and backgrounds, in addition to extra labor costs for lamps, etc.

Proponents of the Technicolor process will resist vigorously the citation of color film costs at 5.8 cents per foot. They hold, and not without justification, that the price per foot will be lowered with increasing use of color by producers. Lowered it certainly will be, *must* be, but it appears that 3 cents per foot is the rock-bottom figure attainable by even the most optimistic colorists; which still leaves a balance of 1.2 cents per foot in favor of black-and-white prints.

Champions of color will go to the mat with anybody on this latter cost difference, and will rend the heavens with their cry that color is more than worth the difference. But is it?

The ballyhoo surrounding the release of "Becky Sharp" was in the best traditions of motion picture publicity, which is to say, at the very least, that it was vigorous and attention-compelling. Potential customers were led to believe that Technicolor would bowl them over and precipitate a box-office

revolution comparable with the upheaval occasioned by sound pictures. As a plug for "Becky" this was all very well; but did close inspection of this feature lend credence to the pre-release ballyhoo and set the customers palpitating for the next color feature picture? We think not.

"Becky" is held to have been an unfortunate choice for the first all-color feature release; and with this opinion we agree. Still, it cannot be denied that "Becky" gave the color technicians a rare chance to exercise their talents, and the finished product undoubtedly represents their very best efforts. As entertainment, apart from the novelty of color, "Becky" was a pancake, but nobody seriously interested in the possibilities of color as an aid to this slightly punch-drunk business paid much attention to other than the color process.

It is true, we think, that color diverts one's attention from the story and militates against that calm interest that is the primary requisite for a sucessful movie presentation. And "Becky" conclusively demonstrated that henceforth the sly little vixens who at 40 years of age essay the role of sweet schoolgirls, had best wear high collars and long sleeves. This goes double for the durable male heart-flutterers who daily leave the set to rush home to their grandchildren. Technicolor lighting is that discerning and ferrets out the age lines of all who tread before it.

'Becky' No Box-Office Champ

"Becky" cost its producers more than one milion dollars before a single release print was made, as compared with an average cost range of from $185,000 to $300,000 for other major studio program features. And "Becky," not forgetting its chief function as the herald of Technicolor, was only a fair program feature.

But, do we hear it asked, didn't color make "Becky" a more valuable box-office property and attract a sufficiently greater number of customers to at least justify the added cost of the color sequences? A definite "No" is the answer supplied by the box-offices of theatres which thus far have played "Becky"—apart from the scattered few de-luxe showings which were given extensive and expensive special exploitation attention.

And so it appears that all-color feature films not only fall short of "revolutionizing" the motion picture business but actually fail to earn their keep, even on the basis of hopeful expectancy that increasing use of color will drive the production cost down to 3 cents per foot.

One suggestion advanced to overcome the high cost of all-color features is to incorporate color sequences in black-and-white pictures. Past experience has demonstrated beyond question, we think, that color sequences are much more unsatisfactory than no color at all, the transition from black-and-white to color, and *vice versa*, comprising all the elements necessary for administering a first-class shock to the sensibilities of the onlooker.

Noticeably lacking in "Becky" were outdoor shots, and a constant level of illumination contributed to a "flat" presentation throughout. Of interest in this direction is the appended very worth while contribution of Dr. A. N. Goldsmith to the color-film art:

> "Until recently the color motion picture companies fought shy of using or taking out-door scenes to any extent, for later theatre presentation. They seemed to restrict themselves to studio material taken under very closely regulated conditions. Of course, that is a severe restriction and sooner or later there must be plenty of out-door scenes upon the screen.
>
> "If the light changes in an out-door scene as it does every time a cloud drifts across the sky, the natural effect will be to have it show upon the screen. I am not so sure that the artificially perfectly maintained color in a studio production of color motion picture is either a desirable or a faithful presentation. If we walk around this lecture room, our apparent color changes as we get nearer the green-gray reflecting walls or the orange-yellow lamps. If a color photograph were to be made of us in this room, it should show such effects."

Personally, we prefer a crisply lighted black-and-white picture to even the best color job we have seen. The former process is not hedged about with the limitations imposed by color production. Adherents of color can muster all the witnesses they choose to dilate on the "art forms" of color, but we unhesitatingly vote for a black-and-white that presents true light and shadow, fine background lighting, crisp definition and, if and when necessary, that pasty grey that is so abhored by critics who know nothing of motion picture set lighting.

Where is the Money Coming From?

To sum up, it is our opinion that Technicolor has failed to demonstrate any artistic superiority over black-and-white. This opinion is subject to immediate revision, of course, should some startling technical contribution wash away the many shortcomings so apparent in "Becky Sharp."

The answer to the economic possibilities of all-color features lies without our province, since the box-office tally sheets on "Becky" are most expressive on this point.

We're for anything that will pep up box-offices, of course, but we suggest extreme caution in applying a stimulant that might possibly kill before it cures. Technicolor is compared favorably with sound pictures as another box-office bonanza, but it hasn't provided any basis for such a comparison. All-color feature films will cost this industry great gobs of additional money. We rise to ask, "Where is the industry going to get it?" Certainly not from the 10- and 15-cent theatres comprising a majority in the industry and which are having a tough struggle under present conditions—including the paying-off for the "blessings" of sound pictures.

Of special interest to projectionists is the fact that Technicolor officials are deeply concerned about the insufficiency of illumination in a majority of theatres. The new Suprex lamps fill the bill perfectly, of course (although we think that prevailing Suprex amperage levels are slated for another boost shortly). Theatres still using low-intensity equipment will continue to give wholly unsatisfactory color reproduction.

Sound Equipment Profits

EVIDENCE submitted to the Federal Trade Commission in its investigation of the A. T. & T. structure indicates that Erpi made a net profit of $9,450,000 since its organization in 1927, a period of eight and one-half years to date. Profits would have been much larger were it not for the lickings Erpi has taken in court cases and patent proceedings, notably the Warner case which cost Erpi three millions to settle, plus trial expenses.

Erpi is welcome to these paper profits for the time being. Question: What large sound equipment company plans to ask Erpi for an accounting of its profits and practices in this field since 1927?

Incidentally, Erpi's reply to the campaign by I. P. against the extension of Erpi influence in the theatre servicing field was to cancel its advertising. I. P. can get along nicely without Erpi support, and the latter's action is a direct slap at the craft rather than at I. P. We hope that the craft is duly appreciative and is exerting every effort to help Erpi's business.

A So-Called Voluntary NRA

FRIENDS of the late-lamented NRA have put their heads together and concocted some fantastic scheme for a "voluntary" NRA which will take some high-sounding association name and proceed to endow the industry with its blessings in the form of self-regulation. Labor is positively declared "in," of course.

We have one comment to make: If the NRA compulsory arbitration clauses were bad medicine for Labor, then this proposed organization for "self-government" is positively poisonous. The arbitration proceedings concocted for this new all-industry organization will slaughter Labor in no time.

Labor should remain aloof, and let the producers and distributors slaughter the exhibitors on film rental practices in some private arena.

A. T. & T. Television Plans

THE Federal Communication Commission has granted A. T. & T. permission, with restrictions, to install a coaxial cable between New York and Philadelphia for experimental purposes. This news occasioned more convulsions by the picture industry induced by the fear that pictures were to be no more.

Dr. A. N. Goldsmith's article on television (I. P. for May, 1935) said all there was to say on this topic of motion pictures vs. television, and not a few of the Doctor's ideas were snitched to make up the appended statement on the aforementioned coaxial cable.

A. T. & T.'s Coaxial Cable

1. The coaxial cable, work on which was commenced by A. T. & T. in 1920, permits the simultaneous transmission of 200 or more telephone messages. It is really wholesale telephony.
2. The coaxial cable would permit two-way television-telephony (acoustic and visual communication), between two points.
3. The coaxial cable would permit the transmission of a television program from, say, a New York studio to a broadcasting station in Philadelphia, for subsequent rebroadcast through the ether in the usual way. This practice would be nothing different than the means now employed in radio broadcasting for covering wide areas.
4. It would be possible theoretically to send a television program from, say, New York to Philadelphia and thence, by means of an extension of the coaxial cable, to run lines into all manner of private homes and apartment houses, just as is now done with telephone lines.

Now, then, it can be said that Points 1 to 3 aforementioned comprise legitimate and proper activities of A. T. & T. in a field in which its patent rights are complete, exclusive and absolute. Experimentation in these directions can continue until A. T. & T. is completely satisfied in every respect.

Point 4, however, is something entirely different. In the first place, coaxial cable is terrifically expensive, comparatively speaking, and it would seem to be the height of folly to run such a cable through streets and country lanes, as the phone line is now run, simply to supply one picture image—on a line capable of carrying 200 telephone messages.

A. T. & T. Restricted in Radio

Moreover, and this is most important, A. T. & T. has *no right at all* to do any of these things by radio. A. T. & T. cannot even manufacture an acoustical or television transmitter, the rights to which are vested exclusively in RCA, as far as A. T. & T. is concerned. That deal is set—signed, sealed and delivered.

The rental charges on the coaxial cable would be much too expensive to encourage A. T. & T. television activity in that direction. Furthermore, the tradition of free advertising has been firmly fixed in the American mind by radio activities to date, thus setting up another well-nigh insurmountable obstacle in A. T. & T's path.

Television, when it comes, will be transmitted by radio, and this being so, it is apparent that RCA has the inside track.

Leading Citizens Perform

THE story of the Paramount reorganization is one for the book. First there are hordes of lawyers, trustees and what-have-you who have applied for a mere three million in fees for their valiant work in "guiding" the reorganization through to a glorious conclusion. Next come Sir William Wiseman, of Kuhn, Loeb & Co., and John Hertz of Yellow Taxicab fame—names to conjure with, these. Wiseman admitted that, although he held not a nickel's worth of Paramount bonds, he made considerable money while trading therein from "the inside" as a member of the bondholders' committee. Kuhn, Loeb profits during the period that a partner (Wiseman) was on the "inside" amounted to a paltry $334,995.

Mr. Hertz, another paragon, took the stand to discuss, quite informally by the way, how he had to "push Adolph Zukor around" in order to attain his economy goal. Hertz also had some uncomfortable minutes on the stand when discussing the handling of Paramount business by firms with which his relatives were connected.

All nice people, these who dug deeply into the Paramount melon. During all this time, of course, Hertz was busy firing cleaning women who drew as high as $11 weekly—in the interests of economy; and Wiseman was very busy "protecting" the interests of bondholders. The lawyers were busy only with making out their own bills. Lovely people, these.

★ C-O Rectifier Aging

NO DEFINITE conclusions have been reached in the investigation instituted by I. P. relative to the "aging" or "break-in" period characteristic of copper-oxide rectifiers, as a result of many inquiries received from the field. As this aging proceeds it becomes necessary to readjust the transformer connections by going to the next higher set of taps.

The well-known characteristic of copper-oxide rectifiers apparently has been the subject of numerous discussions since the introduction of this unit in the projection field, and it appears that considerable detrimental misinformation has been spread by those who are not so favorably inclined toward their use for projection work.

In line with the policy of disseminating factual information anent the operation of equipment under actual working conditions, I. P. assigned a competent investigator to the job of reporting on the facts incident thereto. Excerpts from this special report are appended hereto:

"I regret being unable to report definite conclusions arising from my investigation into the aging of copper-oxide rectifiers. The fan-cooled units now being used in the projection field apparently do not follow the same curve of aging as do other types. It would seem that aging takes place at a much lower rate and to a much less extent than in other types of rectifiers.

Longer Aging Period

"I found that the very first units of this type, which were put into service more than eight months ago, are still running at the initial setting without any decrease in output. Ordinarily, we could expect that the aging during the first six months would be more rapid than at any other time, and I believe that the makers originally calculated that it would be necessary to readjust the transformer connections after this period of service, going to the next higher set of taps.

"I have been unable to find a single case thus far where it has been necessary to make any change in the setting, even on the oldest units (that is, eight or nine months old).

"It would seem, therefore, that reports from the field which you cited when assigning this work, to the effect that rapid aging was causing readjustment of the taps after comparatively 'short periods' of operation, are not based on fact but rather suggest intensive propaganda efforts by those who probably look with disfavor upon the advances made in this field by the copper-oxide rectifier.

"This matter may be kept open for the time being, with a further check to be made within, say, another six months, at which time it should be possible to reach certain definite conclusions on operating characteristics."

Which, for the present, is that. I. P. readers who are using this type of equipment are invited to submit their findings for publication.

Step-By-Step Analysis of Sound Reproducing Equipment

By AARON NADELL

XII. Western Electric 702-B Control Cabinet

FIGURE 1 is a schematic diagram of the Western Electric 702 B Control Cabinet, one of the most widely used W. E. faders. It performs double duty, being both a switch and a volume control. As a switch, it operates to connect the system amplifier to either of the two projectors, and contains a special key switch for the use of a third projector, if one is installed. As a volume control, it acts by changing the nature of the transmission line between the projectors and the system amplifier without destroying impedance match at any volume setting whatever.

This last is the most interesting function performed by this circuit. It must, as a volume control, alter the amount of current flowing through the transmission line to the amplifier, yet it must not change the impedance of that line. More detailed study of the wiring arrangements will show how this is possible.

Figure 1 receives sound current from the projectors only; it does not discriminate between sound-on-film and sound-on-disc. When it is used with a W. E. Universal Base, the switching between sound-on-film and sound-on-disc is done on the base itself; with the earlier style W. E. sound attachments a special switching cabinet designed for that purpose is mounted on the front wall of the projection room, directly above Fig. 1. The sound input is wired to the row of seven terminal posts at the top of the drawing. The sound output is taken from the two terminal posts at the bottom center of the drawing.

The input binding posts are marked, from left to right: "G", for connection to the system ground; a pair designated as "Rep.", for connection to Reproducer (projector) No. 3, where there is one; a pair labelled "W" for connection to the "White" projector, which is normally the right-hand or No. 2 machine; and a pair marked "R" for connection to "Red" or left-hand or No. 1 projector. These seven terminals thus consist of three pairs and a ground, and it will be observed that four of the seven posts are connected together and grounded.

Beginning at Terminal No. 6 a wire runs straight downward, past the common jumper, to the right-hand side of resistor 1-FK, still downward to pick up the ground connection to the cabinet frame (which is thus grounded both through its connecting conduit and through the system ground water-pipe connection to terminal "G"), and down another inch and a half to the central point of the long, horizontal resistor assembly. Thence at an angle left and down for about ¼ inch, and straight down to the right-hand output terminal.

Thus, one side of this transmission line between projectors and system amplifier runs solid through Fig. 1, and this is the side that is grounded. In other words, if we start at the system amplifier and trace this transmission line backward to the projectors, we find that one of its two wires runs unbroken through Fig. 1 to the input side, and there branches into four parallels, one of which goes to each of the three projectors, while the fourth is grounded.

The first requisite here is to understand some of the physical arrangements of this fader. The long series of resistors that stretch horizontally across Fig. 1 are in physical fact arranged in a circle. Each of the two halves of the horizontal line of resistors, both the "Red" and the "White" halves, are therefore semi-circles. The arrowhead shown touching Terminal 5 of the Red resistance assembly is a movable contact, pivoted at the center of the circle. By turning a large knob on the outside of the cabinet the projectionist can swing that arrowhead through nearly a full circle, and cause it to make contact with any of the 31 resistor terminals shown in the drawing. In Fig. 1 the arrowhead is touching Terminal 5 of the Red side of the fader. Therefore, this fader (a switch as well as a volume control) is connecting the Red, or No. 1, Projector to the system amplifier, as can be seen by tracing the circuit backward from the fader output.

We have already traced the grounded side of this transmission line back from the amplifier through Fader Output Terminal No. 16. Now tracing in through Output Terminal No. 15, our line runs up, left, up, and right to a point of junction. From this point one branch runs right another ¼ inch, and up to a switch prong, which in this drawing is open-circuited and can be ignored for the moment. (The two heavy horizontal lines of that switch indicate not electrical connections but insulating bushings that cause several prongs to move together as one unit).

Returning, therefore, to the point of junction, we trace up, right and down to the long central prong of the set of three switch prongs shown just to the left of resistor 1-ED.

That switch is closed in the drawing to the left-hand prong; therefore the circuit continues through that contact and up, left, down, right and up to the fourth prong from the left of the lower assembly of seven switch prongs. Thence through the switch contact to the third prong from the left, and down, left, down, right and up to the arrowhead. Through the arrowhead to Red contact point 5. Upward through the 190-ohm vertical resistor to the horizontal resistance. Left through the horizontal resistors to the extreme left end, then up through the 223.5 vertical resistor. Thence right and up to the extreme right-hand prong of the seven-prong switch assembly of Key switch 479-GS; thence to the second prong from the right of that assembly; thence right about 2 inches to the central prong of the left-hand, three-prong assembly of the 479-K key switch; thence to the right-hand prong of that assembly, and thence up to the ungrounded side of "R" input.

Thus we see that the ungrounded side of "R" input connects, through some switches to be examined later, and through the 223.5 ohm vertical resistor to the extreme left-hand end of the horizontal resistance assembly. And the grounded side of "R" input has already been traced to the central or "O" tap of the horizontal resistor line. Therefore the "Red" resistors of that line are connected directly across "R" input.

The grounded side of this fader's output (Output Terminal 15) also runs solid to the "O" or central tap of the long resistor line; while the ungrounded output (Output Terminal 15), has been traced through some switches to the arrowhead. Therefore:

The "R" input looks into the Red horizontal resistors. The common output looks toward whatever portion of those resistors may be included at the moment between the "O" tap and the arrowhead.

Fader Input Impedance

It is now possible to inquire into the impedance arrangements. Standing at "R" input and looking into the fader, the 223.5 ohm vertical resistor might

equally well have been drawn horizontally at the left-hand end of the Red series, since it is wired in series with all the Red horizontal resistors. The Red projector output therefore "looks into":

223.5	7.18
80.6	5.10
57.3	3.61
40.4	2.56
28.7	3.08
20.3	2.32
14.3	.584
10.17	.196

TOTAL: 499.900 Ohms.

The output impedance of the projector is 500 ohms.

Fader Output Impedance

Now, to consider the output impedance of this circuit, assume the arrowhead contact were moved to Red volume control Terminal 15. Then all the red horizontal resistors, in series, would look toward the fader output, and, consequently, the system amplifier input. The output impedance would therefore be the same as the total shown above, except that the No. 5164 vertical resistor (223.5 ohms) at the extreme left is no part of the output circuit and must be subtracted from that total, leaving an output impedance of 276.40.

On the other hand, with the arrowhead at point 5, as shown, the output impedance would be 190 ohms for the vertical resistor in series with point 5, plus all the red horizontal resistors between point 5 and point 0, or:

Ohms
190.
2.56
3.08
2.32
.584
.196
198.740

With the arrowhead on volume control point 1, the output impedance is, as the drawing shows, 190.196 ohms. The output impedance of this fader therefore remains approximately constant (between 190.196 and 276.40 ohms), at all ranges of volume setting. The input impedance of the system amplifier is 200 ohms and "looks into" the output impedance just given.

Maintaining this approximately constant impedance is the function of the vertical resistors that extend downward from the horizontal resistor line. The drawing shows that from points 1 to 7 (the horizontal resistance being relatively small) all the vertical resistors have a value of 190 ohms. On the other hand, the vertical resistor in series with point 14 (the horizontal resistance being large) is only 42.4 ohms. If the vertical resistors were omitted from this circuit the output impedance at point 1, for example, would be only .196 ohms working into 200 ohms, which would be a very serious mis-match.

The drawing also shows that such small mis-match as occurs in this fader is found chiefly at the higher settings. Impedance mis-match causes loss of volume, which is more tolerable at the high settings than at the very low ones, since it helps to prevent any possible amplifier overloading.

This arrangement constitutes a T-pad. The 223.5, 5164 horizontal resistor, plus horizontal resistors between point 15 and arrowhead, constitutes one half of the top of the T. The other half of the top consists of whichever of the vertical resistors below the horizontal series is at the moment in contact with the arrowhead. The horizontal resistor series from the arrowhead to 0 is the upright limb of the T.

With the arrowhead on point 15, however, the arrangement is an L-pad, since there is no lower vertical resistance in series with point 15. L-pads and T-pads are very commonly used in speech transmission lines to maintain approximately constant impedance while varying volume.

Why the Volume Varies

To understand the variation in volume obtained with this constant-impedance arrangement, suppose the arrowhead to be set at point 1. Then the relatively very small voltage drop developed between point 1 and point 0 is wired across the system amplifier input through 190 ohms series resistance. On the other hand, with the arrowhead on point 14, very nearly all the voltage drop developed by the input sound current across the long line of horizontal resistors is connected across the system amplifier input, through the much smaller series resistance of 42.4 ohms.

White Side of the Fader

The White circuits of this fader duplicate the Red circuits, but operate on the right-hand half of the horizontal resistance line. Consequently, by swinging arrowhead through zero point to the white side, the projectionist changes-over from one projector to the other, the circuits of Fig. 1 performing the work of a switch. Having traced the Red circuits backward from the fader output (as more convenient while the drawing was relatively unfamiliar) we can now trace the white circuits forward from the input.

The left-hand, or No. 4, White input terminal is wired to the input jumper, and may be traced left to the vertical line running downward from input terminal No. 6 to the frame ground, to Point 0 and thence to Output Terminal No. 16. The right-hand white input terminal, No. 3, is wired to a line running down, right and up to the left-hand prong of the right-hand three-prong assembly of the 479 K key. Thence to the center prong of that assembly and right to the center prong of the lower three-prong assembly of the 479 GS key. To the left-hand prong of that assembly and down, right and down to the right-hand, or White, 223.5 ohm resistor, and thence to the extreme right-hand end of the horizontal resistor series. The White input therefore looks directly at the right-hand half of that series.

The output White circuit consists of one wire which runs from Point 0 to the grounded, or No. 16, Output Terminal, and of the arrowhead (when thrown to the White side) which runs through switches to No. 15 Output ter-

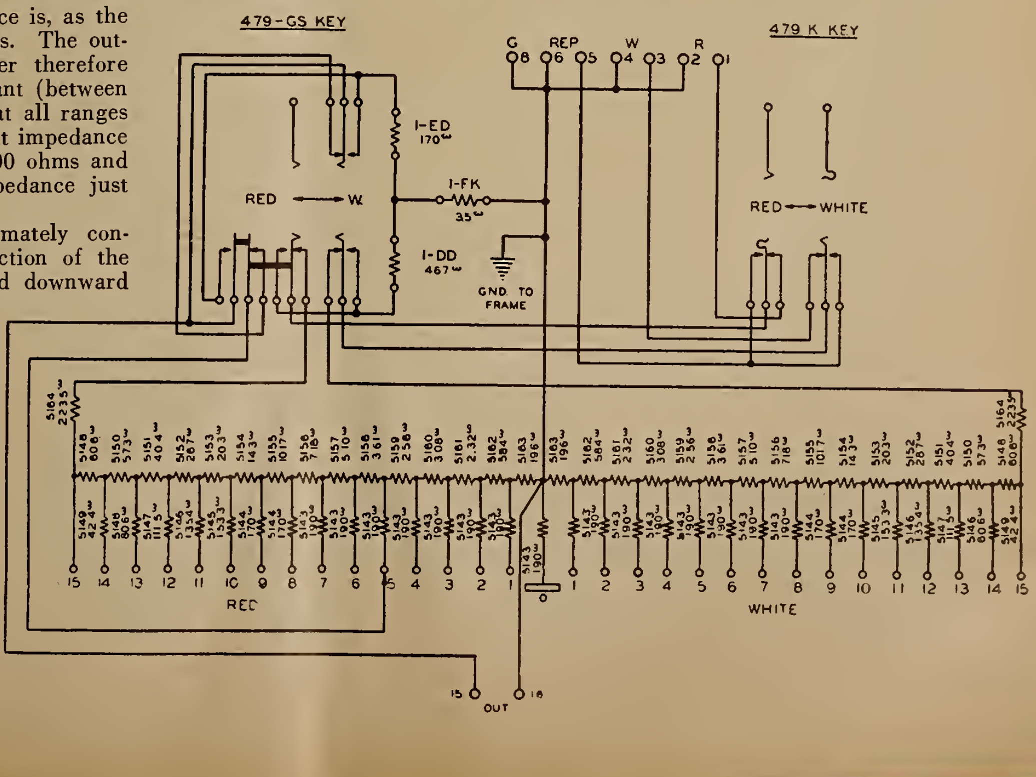


FIGURE 1

minal. Tracing outward from the arrowhead, the drawing is: down, left, up and right to the third prong from the left of the seven-prong switch assembly. Thence to the fourth prong from the left. Thence left, up, right and down to the left-hand prong of the upper three -prong assembly of key 479 GS. From the center prong of that assembly up, left, down, left, down and right to Fader Output Terminal 15.

Therefore, just as on the Red side, whatever portion of the right-hand half of the horizontal resistor line is included between 0 and the arrowhead, is connected across the system amplifier input, through the series resistance wired to whichever fader point the arrowhead may be touching.

With the arrowhead on Fader Point 0, the 190 ohms in series with that point is connected across the system amplifier input and 500 (or 499.90) ohms across each projector output. However, no sound is heard because no current flows in the 190 ohms in series with Fader Point zero, and the amplifier input does not bridge across any voltage drop, therefore no current flows in the amplifier's input transformer.

479K Key Circuit

In physical construction this key is a double-throw toggle switch. The double arrowhead labelled "Red—White" indicates that the four long prongs may be pushed to either left or right. The two upper prongs carry no connections and may be disregarded. The two lower prongs serve to connect a third projector as a substitute for either of the other projectors, according to which way the switch is thrown.

If the 479K key is operated to move the "Red—White" arrowhead leftward, no change takes place in the connections of the right-hand three-prong assembly: the prongs are bent a bit but the contacts remain as shown in the drawing.

Consequently the white ungrounded line remains connected as it was, and the white projector will operate through the fader precisely as before. In the left-hand three prong assembly of this key, however, the circuit that was closed (to Red ungrounded input terminal) is opened, and contact is closed instead to No. 5 input terminal, the ungrounded input of the third projector. The Red projector output is therefore open-circuited, and the No. 3 projector operates through the Red side of the fader, precisely as if it were No. 1 projector.

Operating the key to move the "Red—White" arrowhead toward the right leaves the connections of the red projector unchanged except for slightly bending the spring prongs, but substitutes Projector No. 3 for the white projector, which is simultaneously open-circuited.

479GS Key Circuits

The more complicated left-hand key has three sets of prong assemblies: the lower left, seven prongs, and the upper and lower right of three prongs each. The upper left-hand prong has no con-

(*Continued in Col.* 1, *next page*)

Development of the Motion Picture Projector

By THOMAS ARMAT

Nine out of ten projectionists, if asked who "invented" or developed the motion picture projector, likely would reply: "Thomas A. Edison." But he didn't; nor did he believe it possible to develop such a mechanism until he actually witnessed a demonstration. This and many other interesting points are included in the appended contribution by T. Armat, to whom is due the major share of credit for the development of a projector the basic features of which remain unchanged to this day. The Historical Committee of the S. M. P. E. deserves the thanks of the industry for this, to us at least, absorbingly interesting contribution to the literature of the art.—Editor.

II

THE Raff and Gammon licensing arrangement started off auspiciously and financial returns were satisfactory, but troubles developed shortly. None of my patents had been issued at that date, and the applications were still pending in the patent office, two of them involved in "interferences" which greatly delayed their issue. No patent protection could be given until patents were actually issued. Piratical machines began to appear, and, in the absence of patents, could not be stopped. Later on the Edison Company began to be slow in supplying films. Friction, for that reason among others, developed between the Edison Company and Raff and Gammon. Still later the Edison Co. began to market a machine that infringed my pending patents.

As soon as my patents were issued I organized a company, to which I transferred my patents. Warnings were sent out to infringers, and suits were filed. In many cases the suits were rendered fruitless by the simple expedient of fading away on the part of the sued infringer. The Edison Co. was making and selling large numbers of machines that they called *projectorscopes* which infringed no less than three of my patents.

We notified users of the machines that they must promptly arrange to pay us royalties for their use or they would be sued for infringement and damages. The Edison Co. notified users of projectorscopes they had sold that they would be protected against any suits that we might bring. That made it necessary for us to sue the Edison Co. In the meantime a suit we had brought against the Biograph Co. reached its final stage and was decided in our favor, and the company was enjoined. On the strength of that decision an injunction was obtained against the Edison Co. The Edison Co. had pending in the Patent Office an application covering the only successful method of taking motion pictures and an application covering the perforated film.

So long as the Edison Co. and my company were fighting each other, no exhibitor could give an exhibition without risk of being sued by one side or the other. I had pointed out a number of times to Edison the obvious advantages of our getting together on some basis that would not involve the sale of projection machines, but without avail. After we obtained the injunction against the Edison Co., they tried in various ways to obtain a license from my company under which they would be permitted to sell machines. To that I declined to agree.

From the beginning I had refused to sell machines, or to license others to do so, for the reason that I felt that whatever monopoly we might be entitled to under our patents would be destroyed by any sale of machines; and I also felt that any profit we might make out of the sale of machines would not be remotely commensurate with the earning power of the machines themselves. I wanted a royalty from exhibitors, small enough not to be felt by them, but which in the aggregate would net a handsome income to my company.

The suit against Biograph was for an injunction and damages of $150,000. Damages were also asked in the suit against Edison. Both companies posted bonds and prepared appeals. While damages in patent suits are rarely collectible, a favorable decision in an injunction suit where damages are claimed creates a very uncomfortable feeling on the part of the defeated party and the holders of any of their securities.

The American Mutoscope and Biograph Co. had outstanding a bond issue of $200,000. Some of the bonds were held by the Empire Trust Co. of New York, who took notice of the success of our suit for injunction and damages against the Biograph Co.

Among the stockholders of the Empire Trust was J. J. Kennedy, a very distinguished consulting engineer as well as a man of rare business ability, who was requested by the Empire Trust Co. to study the motion picture patent and commercial situation and work out a plan that would help Biograph and its bondholders out of their difficulties. Mr. Kennedy got in touch with Mr. H. N. Marvin, also an engineer of distinction

(*Continued on page* 24)

nections, and can be disregarded, as it does nothing.

This switch is included for use in emergency, in case one of the resistors or circuits in the fader proper should develop a defect. Together with the 1-DD, the 1-ED and the 1-FK resistors, constituting a T-pad, it forms, in effect, a substitute fader. When it is thrown to Red, those resistors replace the red half of the fader proper; thrown to White, the white half. Volume control is no longer possible when this substitution is used, but it serves as a fixed volume setting equal to about Point 9 of the fader proper. If volume changes are necessary, they must be made at the system amplifier or with the exciting light, until fader repairs can be effected.

Suppose the 479GS key to be moved leftward, to Red. All the grounded lines remain solid, input to output, as always, since there are no switches in the grounded side of this transmission line. Tracing the ungrounded White input shows no change; however, the arrowhead is open-circuited. But tracing the Red input line when the 479GS key is thrown to Red, shows the Red input opened and resistors 1-DD and 1-FK substituted for it as follows:

From the ungrounded Red input (Input Terminal No. 1) down, right and through the left-hand long prong of the 479K key, thence left to the sixth prong from the left of the seven-prong assembly of the 479GS key. This is no longer closed to the seventh prong of that assembly and thence to the high side of the Red resistance line, but, instead, to the fifth prong of the seven-prong assembly, and thence right, and up through the 1-DD resistor, and right through the 1-FK resistor to the other side of the input line. These two resistors total 502 ohms, connected across the red projector input.

The voltage drop developed in the 1-FK resistor is connected across the fader output as follows: one side of that resistor goes to the grounded side of the line, and then to Output Terminal No. 16. The other side runs through the 1-ED resistor (total Fader output impedance, 205 ohms), and thence up, left, down and right to the extreme left-hand prong of the seven-prong assembly. This is now closed to the second prong from the left, through which the circuit continues down, left, down and right to the ungrounded output terminal.

Thus a substitute T-pad has been switched in in place of the defective Red side of the fader. If the White side of the fader still operates normally, the 479GS key can be thrown to neutral for projection from the White machine, and the white side of the fader operated in the usual manner. Or, the GS key can be moved rightward to "White" position, and 1-ED, 1-FK and 1-DD used in place of the usual White resistors. In that case the circuit runs from the ungrounded White input, No. 3, down and right to the right-hand prong assembly; from the central prong of that assembly left to the central prong of the lower right three-prong assembly of the 479GS key (which is now closed to the right instead of to the left as the drawing shows it); thence down and upward through 1-DD and back to the grounded side of the input, through 1-FK.

The potential difference developed across 1-FK connects to the ungrounded output through 1-ED and the upper three-prong assembly of the GS key, which is now closed to the right. From the central prong of that assembly left, down, left, down and right to the ungrounded output terminal.

This arrangement works precisely the same way if No. 3 projector has been switched in, through key 479K, in place of either the Red or White projector, since, as has already been traced, in that case No. 3 merely connects to one of the two central prongs of the K key in place of the projector for which it substitutes; and it is from those central prongs that the GS emergency key derives sound current.

The W. E. 705-A Control Cabinet

By AARON NADELL

Articles in this series (Step-By-Step Circuit Analysis) requiring close attention and careful checking, have been limited to one in each issue. It is believed, however, that the best interests of readers will be served by simultaneous presentation of two of the three articles relating to control cabinets, the final installment of which group will appear next month.—Editor

FIGURE 1 is a schematic diagram of a combination volume control and switching circuit, or fader. It contains one feature that is often overlooked in these days of sound-on-film operation, namely, the switching arrangements for the little-used disc reproducers. These witches and their wiring remain installed and "alive" in a great many theatres and consequently are capable of causing trouble and of complicating the work of tracing troubles that arise elsewhere.

The input-output terminal block is shown at the left of the drawing. It consists of the upright rectangle and carries eleven terminal posts. The four lower posts are labelled "disc" and are numbered in pairs—Pair No. 1 and Pair No. 2—referring to the projectors to which they are wired.

At the top of the rectangle are five similar terminals. Four of them are similarly numbered, but are labelled "film." The fifth, or top, terminal connects to the cabinet cover and thence through the connecting conduit to the ground. Apart from the ground terminal, there are eight input binding posts, providing for four input circuits. At the center of the rectangle are two more binding posts, not numbered, but merely labelled "output."

Since the drawing shows no other posts for external connections, obviously Figure 1 must function to select any of the four input circuits, as desired, for contact with the output line. In addition, as will be seen by tracing the details, it controls the sound volume from the input source thus chosen.

The Ground Circuit

Figure 1 shows three wires connecting to the topmost terminal. One is a heavy line leading downward to the upper of the two output posts, serving only to ground that side of the output line. The second leads from the ground terminal upward and right to the line of dashes representing the metal cabinet cover. A third, labelled "blk" (black) leads right to a loop surrounding two wires. These are therefore shielded wires, and the loop indicates that the shielding has been soldered to the ground line.

Figure 1 of this article appears on the next page.

Tracing the ground wire right and then downward, we see that the shielding of five separate pairs of wires is grounded. That is, all four input circuits and the output circuit run through this cabinet in shielded cable, and all the cable shields are connected to the ground.

The black wire leading to the ground terminal is labelled "G"—the letter can be seen on the terminal block just to the right of the "m" in "film." An external wire, running to a water pipe, or other suitable ground, is wired to this terminal.

The Input Circuits

The No. 2 input pair may be traced directly right from their terminals immediately below the ground terminal. They run to the second and fourth switch-prongs of the lower right-hand switch assembly of the 479-DA key switch. Directly below these the No. 1 film connections run right, up, right and down to the upper right-hand switch assembly of the same key. Ignoring the output line for the moment, and continuing down along the terminal block to the No. 2 disc input, we may trace this right, up and right to the lower left prong as-

sembly of the same switch, and the No. 1 disc input to the upper left-hand prong assembly.

The Film-Disc Switch

The toggle of the 479-DA switch acts to force the long prongs either right or left, according to which way the switch is thrown. The short, heavy black bars are not conductors but insulating studs that cause the two central prongs of each prong assembly to operate in unison.

Inspection of the switch as drawn in Figure 1 shows that all the input lines are open, the switch being in neutral position.

If the double-pointed arrowhead is moved toward the left, pressing upon the two long prongs of the left-hand upper and lower prong assemblies, all the contacts of those assemblies will close. The right-hand prong assemblies remain unaltered by this change. The reverse condition occurs when the double arrowhead is moved rightward.

Disc input No. 1 pair run to the upper left-hand prong assembly, and when the switch arrowhead is moved leftward, that input is connected directly across the right-hand half of the D-86637 potentiometer. Tracing this circuit:

From the lower terminal of Disc Input No. 1 along the blue wire right, up, right and down to the extreme left-hand prong of the upper left-hand prong assembly of the 479-DA switch. Through the switch contact to the second prong from the left. From here rightward along the heavy black line to the third prong from the left of the upper right-hand prong assembly. That prong is open (the double arrowhead having been moved leftward) and the circuit continues right, down, left and down to the upper end of the right-hand half of the potentiometer.

Returning to Disc Input No. 1, we may trace from its upper terminal, along the blue-red wire, right, up, right and down to the third prong from the left of the upper left-hand prong assembly. Through the switch to the fourth prong, the long one, and thence left to the long prong of the upper right-hand switch assembly (which is now open); and thence up, right, down, left and up to the long prong of the lower right-hand assembly (which is open); thence left to the long prong of the lower left-hand assembly (which is closed to one side of Disc Input No. 2), and from this down, right and down to the second terminal from the right of the potentiometer; thence down, right, down, left and down to the potentiometer central point, or zero.

The voltage developed by disc reproducer No. 1, therefore, is connected directly across the right-hand side of the potentiometer (fader) between Point 12 and Point 0. Any desired portion of the voltage drop through those resistors can be connected, as will be seen below, across the input of the system amplifier.

Leaving the 479-DA key thrown toward the left, the No. 2 disc input may be traced as follows:

From the lower of the two No. 2 input terminals right along the yellow wire, up, right and up to the third prong from the left of the lower left-hand prong assembly. This is now closed to the long prong just right of itself, therefore the lower No. 2 disc input terminal is in parallel to the upper No. 1 disc input terminal. From the long prong of the lower-left assembly down, right, down, right, down, left and down to the Zero point of the pot.

From the upper No. 2 disc input terminal right along the yellow-green wire and then up, right and up to the extreme left-hand prong of the lower left prong assembly. Thence through the switch to the second prong from the left of the same assembly, and from this straight down to the upper or No. 12 contact of the left-hand side of the potentiometer. Consequently the left half of this fader is connected directly across the No. 2 disc reproducer.

When the 479-DA key is thrown to the right, these disc inputs are open-circuited and the film reproducer input lines are switched into their places. Consider now this switch as thrown to the right.

Film Input Circuits

From the lower terminal of No. 1 film input right along the brown-red wire, up, right and down to the extreme right-hand prong of the upper right-hand prong assembly. This is now closed to the prong immediately to its left. The circuit then continues through the switch contact to that prong, and up, right, down, left and down to the upper, or No. 12, contact of the right-hand side of the fader.

From the upper terminal of No. 1 film input right along the brown wire and up, right and down to the second switch-prong from the left of the upper right-hand assembly. From this through the switch contact to the long prong just left of it. From this up, right, down, left and up to the long prong of the lower right-hand assembly and thence to the long prong of the lower left-hand assembly. From this down, right, down, right, down, left and down to the Zero contact of the potentiometer.

The voltage output of No. 1 film reproducer, therefore, constitutes a potential difference connected across the right-hand side of this fader, any desired portion of which may be switched across the input of the system amplifier by means of the sliding contact.

No. 2 film reproducer output may be traced through the lower No. 2 film input of Figure 1 right along the slate-red wire and up to the second switch prong from the left in the lower right-hand prong assembly. Thence through the switch contact to the long prong of that assembly. From this leftward to the long prong of the lower left-hand assembly. From this down as before to fader Zero point. This slate-red wire thus is in parallel to the brown wire of No. 1 film input.

From the upper terminal of No. 2 film input right along the slate-colored wire to the extreme right-hand prong of the lower right assembly; thence to the prong immediately to its left; thence to the second prong from the left of the lower left-hand assembly, and from this directly downward to the left-hand portion of the fader, which is thus connected directly across Film Reproducer No. 2.

Fader Input Impedance

The input impedance of this fader can be found by adding the impedances in ohms given along the right-hand half of the potentiometer in Figure 1. The values are the same for the left-hand portion of this fader, the figures being omitted there to avoid crowding the drawing. The inputs to the fader, as we have just seen, are in no way dependent upon the sliding

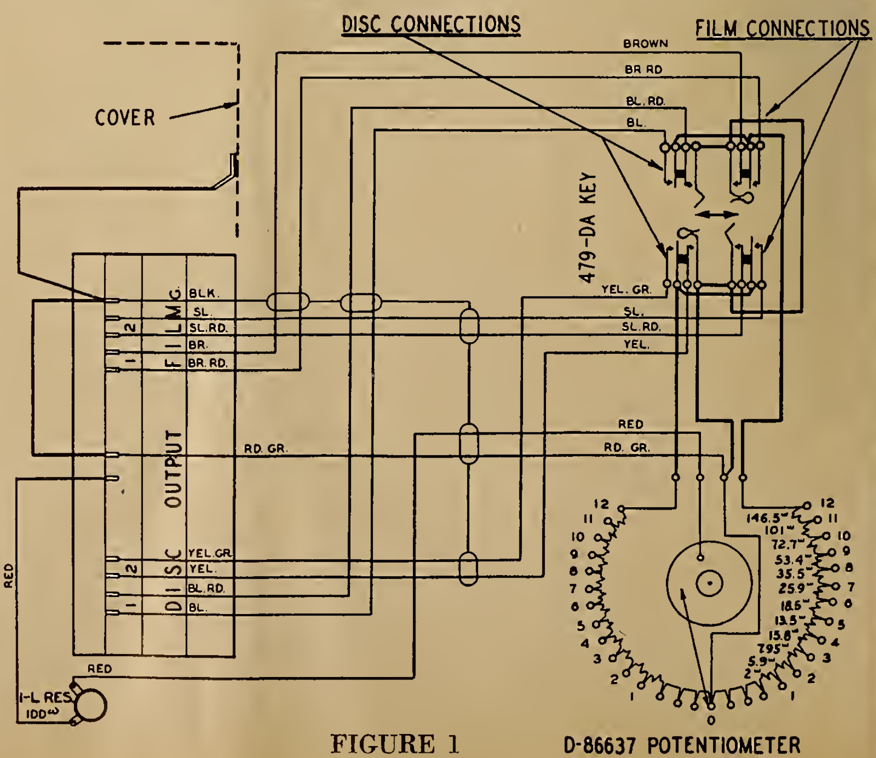


FIGURE 1

contact, but "look into" a full half of the fader regardless of the variable setting. The total impedance in ohms is:

146.5	18.5
101.	13.5
72.7	15.8
53.4	7.95
35.5	5.9
25.9	2.

TOTAL: 498.65 Ohms

In Figure 1 the fader is set at zero—that is, the long double arrowhead connects Zero Contact with the disc at the center of the potentiometer drawing. In the physical apparatus the control knob rotates a short brass bar with flexible pressure contacts at each end. One of these end contacts moves from point to point of the potentiometer contact studs 1 to 12, as the knob is rotated. The other end contact moves around a brass ring, but maintains unvarying pressure upon it.

This bar with its two flexible pressure contacts is represented in the drawing by the slanting line with two arrowheads, one of which rests at Zero Point and the other upon the central disc, or brass ring.

The D-86637 potentiometer is provided with four terminal studs, drawn in a horizontal line at its top center. The right-hand terminal runs directly to the upper end of the right-hand side of the fader. The second terminal from the right is wired down, right, down, left and down to the central point of the fader, and is common to both sides. The extieme left-hand terminal goes to the upper end of the left-hand side of the fader. The second terminal from the left is wired to the central brass ring, and therefore to the variable contact arm.

There are two input circuits to the fader, one to each half. No. 1 inputs, whether film or disc, are run to the right-hand half, that is, across the right-hand fader input terminal and the second terminal from the right. No. 2 inputs, whether film or disc, are connected to the second fader terminal from the right and the extreme left-hand terminal stud.

The fader output also runs through the second terminal from the right and, therefore, from Fader Zero. The red-green wire may be traced from that terminal directly left to one of the two Output Terminals. This is grounded, therefore Fader Zero Point is grounded. And since one side of all the input lines to this fader run to Fader Point Zero, one side of all the input circuits must likewise be grounded through this same connection.

The second fader terminal from the left, which internally connects to the brass ring and thence to the variable contact, may be traced externally to the other output binding post as follows: up and left along the red wire, down, left to and through the 100-ohm I-L resistor, and thence left, up and right to the lower of the two output terminals. The addition of the I-L resistor converts the circuit into an "L" pad, the purpose of which is to improve the impedance match between the fader output and the input of the system amplifier, as will be seen.

Change in Code Seal Set For August 1

Beginning August 1 the seal of approval of the Production Code Administration, which now appears at the start of all feature picture releases, will appear in the same manner as is now employed on short subjects. At present the feature release seal is carried on a separate frame preceding the title frame. Under the new policy it will appear as part of an introductory frame, the proportionate size of the seal and code number to be uniform at all times.

Many projectionists will welcome this change, inasmuch as the code seal often has not appeared at all on the screen, many projectionists, especially in de luxe theatres, considering the seal as a "cold" opening. Producers and distributors, hearing of this skipping practice, raised vigorous complaints because of the danger of running counter to the wishes of the morality groups, whose demands were responsible for the seal in the first instance.

That portion of the potentiometer windings which may be included at any moment between the variable contact and Zero Point, plus the 100-ohm I-L resistor in series, constitutes the output impedane of Figure 1—in other words, the impedance that "looks into" the 200-ohm amplifier input impedance.

This potentiometer, unlike the 702-B Cabinet analyzed elsewhere in this issue, is not equipped with supplementary resistors in series with its contact studs. It is a simple potentiometer and not a T-pad, consequently its output impedances are not as precisely matched as in the case of the other fader.

The 100-ohm resistor in series with the line helps, however, by converting the overall circuit of Figure 1 into an L pad, and thus secures a better output impedance characteristic. For example, assuming the fader to be set at Point No. 2, 102 ohms "look out" into the system amplifier's 200 ohms. If the I-L resistor were not included, only 2 ohms would look into 200 ohms and the mismatch would be decidedly serious.

With the variable fader contact at its maximum setting (Point No. 12) the full 498.65 ohms of the potentiometer winding, plus the 100 ohms of the I-L resistor, or 598.65 ohms in all, "look into" the system amplifier. However, such moderately large mismatches occur only at the highest fader settings, where the resultant loss of volume can be tolerated and any distortion is less noticeable. At all middle settings the output impedance is, because of the 100-ohm output resistor, relatively accurate.

But the figures involved, when compared with those of the 702-B Cabinet diagrammed elsewhere in this issue, illustrate very distinctly the advantage of T-pad arrangements whenever volume controls are used in low-impedance transmission lines.

The output impedances of Figure 1, at the middle fader settings, which are those most often used, are shown in the following table:

Setting	Fader Impedance (plus 100)	Output Impedance
9	178.45	278.45 ohms
8	125.05	225.05 ohms
7	89.55	189.55 ohms
6	63.65	163.65 ohms
5	45.15	145.15 ohms

Any of the above will give substantially satisfactory impedance match to a 200-ohm amplifier input. Consequently, wherever the fader-switching panel of Figure 1 is installed, the amplifier gain control should be pre-set to keep the fader position, under all normal circumstances, roughly within the range given just above.

Australian Projectionists Seek Better Conditions

PROJECTIONISTS have their troubles with exhibitors the world over, according to advices reaching I. P. from Australia. Work conditions in Australia and New Zealand are reported on by the film publication *Everyones* as follows:

Elevation of the pay of assistant-operators in continuous shows throughout Australia to the basic wage will be the subject of a Federal court application unless conferences between Union representatives and employers result in an amicable arrangement.

Assistant operators claimed working hours were excessive and the rate of pay out of all proportion. Ventilation of bio-boxes was bad, they claimed, due to lack of supervision by health officials. Another allegation was that unlicensed operators were employed on country circuits; so it was proposed that police be appointed as inspectors in such places, with authority to prosecute for breaches.

In making assistant operators in continuous houses the special subject of an industrial application, the Union's case is that nine-tenths of them are adults, and the majority married. Yet they must exist on £2/15/- (approx. $13) a week. The executive asks that this be lifted to the basic wage at least.

It is more than probable that the parties will confer with a view to a settlement without the aid of the court being evoked. The move affects assistant operators in continuous shows throughout the whole of Australia.

That conditions are no better in New Zealand is indicated by the appended dispatch from there:

Operators are moving for a Dominion award and the licensing of operators in New Zealand.

For some time discontent has existed among them. So serious has the position become that they are taking steps to protect themselves against unfair treatment by certain proprietors and managers. In many theatres they are compelled to work excessive hours in a vitiated atmosphere without adequate time off for meals, and for wages barely sufficient to support a single man, far less a married man with a family.

Academy Submits 2000-Foot Reel as Industry Standard

Sets January 1 next as effective date for introduction of longer reel length on an all-industry basis. Failure of S. M. P. E. to act may cause delay in adoption as standard.

THE Research Council of the Academy of Motion Picture Arts & Sciences is recommending to the producing and distributing companies that a new reel standard be adopted and that beginning January 1, 1936, all features be released on a 2000-foot reel. Academy recommendations for technique in each department of production, distribution and exhibition, including a summary of the changes necessary in each as a result of the adoption of the longer reel stand are appended hereto.

There also accompanies this article a drawing which contains detailed dimensional specifications for the new 2000-foot reel.

It was pointed out in informed quarters that the Academy's proposed reel is merely a recommendation for a standard, since standards in the motion picture industry are in the hands of the S. M. P. E., which in turn is the only standard-making body recognized by the American Standards Association. Naturally the approval of both these organizations would be necessary before the Academy proposal became an official standard.

It was foreseen that this question of jurisdiction over standards might give rise to a little difficulty, particularly if the S. M. P. E. should desire to change the Academy specifications. No authoritative member of the S. M. P. E. could be reached for comment on this situation prior to press time for this publication.

INTERNATIONAL PROJECTIONIST was able to unearth much unofficial opinion in this connection, however, a majority of which was frankly critical of the Society for its failure to act on a new reel standard despite the fact that the matter has had its attention over a long period of time. Without attempting to detract in the least from the splendid accomplishment of the Academy in formulating this standard, many persons close to the situation pointed out that the Projection Practice Committee of the Society considered the longer reel standard as far back as 1933, and then in 1934 at the Spring Convention in Atlantic City submitted a detailed report that strongly urged favorable action on the longer reel length.

For more than a year now the Society has had the matter under consideration, but has done nothing about it. Academy action on reel length at this time was taken as just another indication that when anybody fails to do a given job within a reasonable time period there will always be found somebody else to do it.

Reel length has been considered from every angle in these columns over a period of several years. By and large the reaction to the new reel length among projectionists is expected to be distinctly favorable, particularly in view of the many one-man projection shifts now working. Local Union organizations in certain large cities—notably in New York, Chicago and Boston—have never approved of 2000-foot reel lengths and, in fact, have passed Union laws which prohibit their use. Sentiment in these territories is hard to forecast at this writing.

INTERNATIONAL PROJECTIONIST invites comment from projectionists everywhere anent the Academy reel proposal, details of which are appended hereto:

Theatre

There will be no actual change in operation in the theatre. A very complete survey shows that all theatres in the United States, with a few isolated exceptions, are equipped to project 2000′ reels without any change or alteration of equipment. Investigation made recently indicates that a great majority of the theatres, not only in the United States but throughout the world, "double" their prints.

Doubling may be described as the practice of cutting the tail end leader from reel 1 and the head end leader from reel 2, splicing the two together and mounting them on 2000′ reels kept at the theatre for the purpose. In a similar manner, reels 3 and 4, reels 5 and 6, etc., are spliced together and projected "doubled." Upon the completion of the picture's run, the reels are cut apart, remounted on the 1000′ reels and sent back to the exchange.

The evil of this practice arises from the fact that with each "doubling" operation, 2 *frames of film are cut away from each reel,* eventually resulting in a considerable jump in the picture on the screen and necessitating replacement of the reel end by the exchange.

The elimination of the practice of doubling will not only result in an economy, but will greatly improve the technical excellence of the show in the theatre.

Distribution

An extensive survey of film distribution regulations, laws, rules, etc., revealed that there are no regulations in the United States which will interfere with the shipment or exhibition of film on 2000′ reels.

It is indicated also that the 2000′ reel will be acceptable for use in all of the foreign countries in which the companies release pictures with the exception of the Argentine, Spain and Puerto Rico.

Projection machines in some theatres in the Argentine will not accommodate the larger reel, which may necessitate the splitting of prints released there into two 1000′ sections. Postal and shipping laws in Spain and Puerto Rico forbid the shipment of more than 1000′ of film in any container, which will necessitate the shipment of film in 1000′ lengths in these two countries.

Exchange

The adoption of the 2000′ reel will necessitate the setting up of one additional operation in the exchange, *i.e., the splicing of the two* 1000′ *(or thereabouts) rolls of print and mounting of the spliced longer roll on a* 2000′ *reel.*

It is recommended that the laboratory process release prints as at present in 1000′ rolls, and ship the 1000′ rolls to the exchange in cans but not mounted on reels, and that the exchanges thereupon splice the appropriate 1000′ rolls together and mount the print on 2000′ reels for shipment to the theatres.

From this point, the print will pass through all of the normal operations of inspection, shipment, projection, etc., in the 2000′ length.

Certain items of exchange equipment must necessarily be altered in order to accommodate the 2000′ reel:

1. *Vaults.* Most exchange vaults are built up on angle iron frames, bolted together. This type of storage vault may be altered very easily and with a minimum expense (which has been estimated at approximately $10.00 per vault, the actual cost depending of course upon local conditions). A number of exchanges are equipped with storage vaults of welded angle iron frames, which will be somewhat more expensive to alter, but in no event will the cost of revising the vaults be a major item of expense.

2. *Rewinds.* An extensive series of tests by the Subcommittee indicates that a rewind having a gear ratio of 2¾ to 1

will turn as easily with a 2000′ *reel as the present* 4 *to* 1 *geared rewind turns with the* 1000′ *reel.*

It is recommended that all new rewinds purchased be geared in a 2¾ to 1 ratio.

3. *Shipping Cases.* Features will be released on 2000′ reels,—short subjects and newsreels will continue to be released on the 1000′ reels until the supply of these reels and cases is exhausted and all equipment is converted to the new standard.

An initial expenditure for sufficient new 2000′ reel shipping cases to handle the feature release of each exchange will be necessary, but the expendable character of this item will permit the greater portion of the necessary expenditure for cases to be charged over a period of time, inasmuch as the new 2000′ cases will be used as releases come out on the longer reels, and the 1000′ cases already on hand may be used for old releases which may still be sent out on 1000′ reels, and for short subjects, news-reels, etc.

4. *Reels.* The reel has been designed for maximum efficiency, at minimum expense. With the release of feature product on a 2000′ reel, the entire character of the reel problem as relating to the exchange is altered. There will be no necessity for the theatres to transfer the film from the shipping reel to a theatre reel unless such procedure is particularly desired by the projectionist or theatre management.

All doubling will be eliminated.

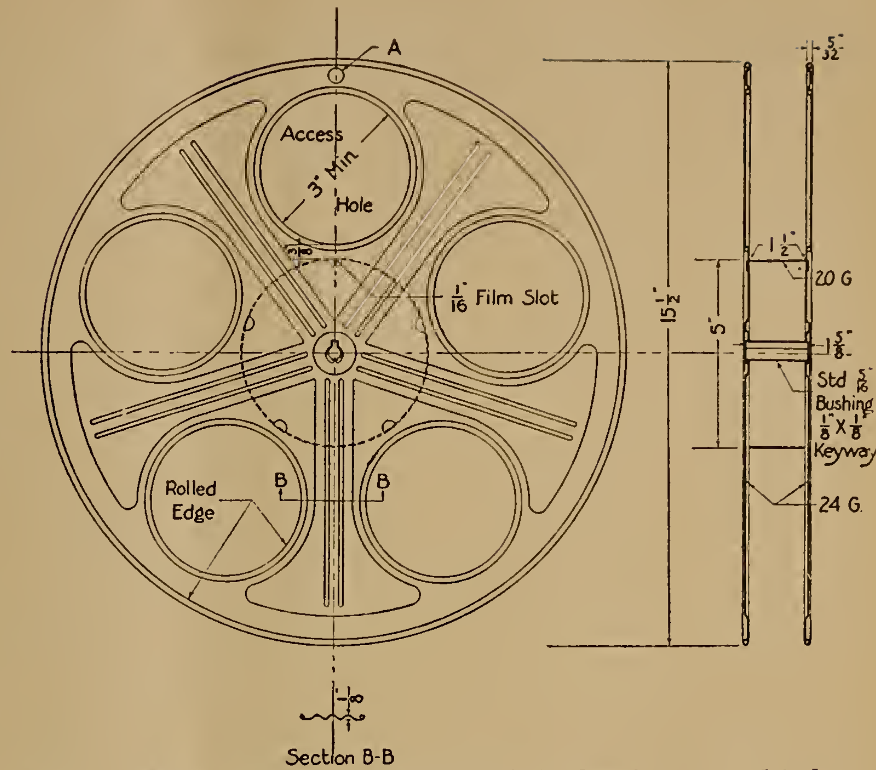
During the consideration of the 2000′ reel, all reel manufacturers were consulted and specifications for the reel were submitted for comment and suggestion. In this manner, in addition to the knowledge and experience of those of the industry who cooperated in the project, the combined technical knowledge of the designers and engineers engaged in the manufacture of reels was utilized, and the specifications for the 2000′ reel as finally evolved seem to be, in the judgment of the Reel Length Subcommittee and the Research Council, the best possible from all standpoints.

Costs No More Than Formerly

A primary limitation that the 2000′ reel, if it were to be finally adopted, must be so designed that the weight and cost of the larger reel should not be more than double the cost of the 1000′ reel was set up. The recommended reel is well within this limitation. Tentative prices submitted by the manufacturers indicate that the new reels may be purchased for somewhat less, in most cases, than double the price of the 1000′ reel, although a definite price of course depends mainly upon the quantity of reels purchased.

However, *there will be no additional cost for reels as a result of the change in reel size,* because of the fact that the total number of reels used will be half the number formerly purchased.

It is recommended that the companies purchase only reels meeting the Research Council specifications which are a part of this report.



Detailed drawing showing specifications of Academy's proposed industry standard for 2000-foot film reel

Editorial

The adoption of a 2000′ reel will result in considerable saving in time and expense in the cutting department, due to the fact that approximately *half* of the number of *reel end changeovers* will be necessary.

The editor assemblying a feature production is now faced with the necessity for finding a satisfactory changeover approximately every 1000′. With the 2000′ reel in use, the end of the first 1000′ will be made as a direct cut, for although the reel will be processed in its present 1000′ length, it will be spliced to the second 1000′ of the picture and the two will be projected as a unit in the theatre. It will thus only be necessary to find a projection changeover at the end of what now corresponds (with the presently used 1000′ reel) to reels 2, 4, and 6.

In order that maximum savings may be achieved, however, it should be emphasized that *each half of the* 2000′ *reel should be kept up to maximum length.*

Feature productions should be so edited that they will reach the theatre in the least number of reels, and in *no event should the total length of any reel be less than* 1700 *feet.*

Specifications of Academy Reel

The reel shall have an outside diameter of 15½ inches, a hub diameter of 5 inches, and an inside clear width of 1½ inches. The center bushing shall be of such size as to provide an easy fit on all standard 5/16 inch diameter rewind and projection machine spindles, and shall have a ⅛ by ⅛ inch keyway.

An access hole for threading shall be provided in each flange adjacent to the film slot, having a minimum diameter of 3 inches, and located as shown on the drawing. The size and position of lightening holes in flanges shall be optional except that the reel must have an acceptable running balance.

Constructional Details

The reel shall be constructed of No. 24 USS gage [.025″] (except the hub which shall be constructed of No. 20 USS gage [.0375″]) with rib heights and rolled edges of dimensions as shown on the drawing except that thinner gages and slightly greater rib heights may be used for economy of construction, provided such design makes up into a reel of equivalent stiffness in the flanges to the one of specified dimensions. A thin gage which might permit denting of the ribs during use but which at the same time would maintain the essential working dimensions of the reel would be acceptable.

The reel shall be entirely free from raw edges on all portions which come in contact with film or the hands. All hand openings and the outer edge of flanges shall be rolled. Flanges shall have an embossed spot near the periphery opposite the opening, adjacent to the threading spot as shown at "A" on the drawing.

Reel flanges shall have a sufficient area of flat contact surfaces on the inside to provide ample bearing for the edges of

the film. Rib heights shall be slightly less than the height of the peripheral rolled edge to allow for stacking. All flanges shall be free from warping or buckling after assembly and shall run true within 1/32 inch when the reel is spun on a 5/16 inch shaft.

Center bushing shall fit solidly into side flanges without looseness when assembled, and shall be of sufficient strengh to withstand the wear and tear of usage. Clinching ears shall fit tightly and shall be pressed down firmly so as to make a solid assembly of the reel and to insure at all times a 1/16 inch slot for threading the film end into the hub.

Material shall be steel with anti-corrosive plating or coating, or non-corrosive alloy. Finish shall be suitable to protect against the wear of use and against the corrosion of ordinary atmospheric influences.

To allow for the utmost freedom in design of the reel, maximum and minimum dimensions are indicated on the drawing wherever possible but where such values are not shown, the specific dimensions shall be strictly adhered to within the limits of good practice.

Weight and Cost

The total weight of the reel and its cost price must be closely comparable to two first class reels of 1000 feet film capacity. Any cheapness in the reel made possible by weak construction shall be deemed unsatisfactory. However, since the reels are intended only to remain in good condition for a sufficient length of time to last the life of the picture, a reasonably thin material may be used provided the flanges are well ribbed to maintain stiffness.

Any concentric grooving in the flanges which will permit layers of film to shift laterally shall be considered unsatisfactory.

Enamel or paint finishes are not recommended and unless they offer exceptional resistance to wear and chipping shall be considered unsatisfactory.

Any reel on which the plating or dipped finish cracks during forming or assembling shall be considered unsatisfactory.

The Cameraman

UNSUNG heroes of successful film productions are cameramen. If the public ever thinks about the photographers at all, they simply believe they turn a crank or push a button to operate the camera's motors. Instead, the whole complex business of picture making devolves, in the final analysis, upon the man behind the lens. Story, acting, talent and directorial ability mean nothing unless they are painstakingly captured in celluloid. And when production executives occasionally find themselves "stumped" in obtaining special effects, they know that somehow or other their cameramen will provide the proper answers. —KARL FREUND.

Theatre Reproduction and Color Feature S. M. P. E. Progress Report

PERHAPS the most needed piece of equipment in the industry is a silent camera. The leading camera manufacturers are working hard, but are not yet able to supply the industry with a camera that fulfills the sound and weight requirements of the studios. In the meantime each studio has been working industriously toward further perfecting their "blimps" by making them quieter and of lighter weight. Some of the "blimps" are sufficiently quiet to meet the most stringent demands of the sound departments, but the weight has been reduced comparatively little, leaving a real need for a one-man unit.

Zoom lenses have made great advances during the past year and, although not yet perfected, a zoom lens can be expected in the near future that will operate at an $f/2.3$ speed from a 35-mm. angle to a 150-mm. angle, making possible a single lens doing the work of at least six lenses of the present type.

Projection or transparency background work has nearly attained perfection during the year. The hot spot, though it still exists, has become a minor difficulty; perfect synchronization and matched lighting have blended composites into a much more beautiful whole than was ever before possible. Improved technic has widened the scope of transparency projection until "location trips" have become one-man jobs, the cast restricting their trips to the studio stage, a large piece of ground glass furnishing the requisite locale of desert, mountains, or foreign countries. Excellent results have been obtained recently.

Color Spurs Carbon Use

The interest in carbon arcs for studio lighting is quite pronounced at the present time, due to the new Technicolor pictures. In order to render the operation of the arcs sufficiently quiet for sound pictures, L. Kolb, of M-G-M, recently built a number of choke-coils of 1000-ampere capacity. Similar coils were built by Mole-Richardson Co., Inc. Each coil contains 300 feet of 1,000,000 circular mil. copper cable, making 36 turns, and has an air core. Such a choke-coil has the advantage of taking care of a large number of arc lamps from its position near the power-house. The ordinary choke-coil, made for individual lamps, must be carried to the motion picture set and located near the lamp it serves.

Along this same line, the W. C. Hollins Electric and Engineering Company of Los Angeles has developed a dry type of electrolytic condenser to replace the regular electrolytic condensers in present use in the studios. Each unit weighs approximately 25 pounds, and has a capacity of 2,500 microfarads. One unit is sufficient for each end of a generator. These condensers are used in conjunction with choke-coils to eliminate commutator ripple. The advantages claimed for the "dry type" condenser are lightness of weight, no care is needed, lowness of price. They have recently been installed in several of the West Coast studios.

There was no outstanding accomplishment in the field of new sound recording equipment during 1934, because major equipment suppliers were embroiled in litigation over the Tri-Ergon patents and hesitated to go ahead with new equipment lines until these patents were finally settled one way or the other.

Considerable attention was given by the public to the sound recording in Columbia's *One Night of Love*, featuring Grace Moore. This picture marked the initial attempt to use the new vertical cut recording system in sound pictures. The songs and orchestral selections were first recorded on wax and later transferred to film in the re-recording process. This gave a final film indistinguishable from an original film recording and superior to a film-to-film re-recording.

RCA Sound Improvements

A new system of recording on film was demonstrated which should serve to improve the fidelity and reduce the background noise of the extended frequency range of musical recordings. The new method can be employed for original recordings that are to be re-recorded for making final negatives. The original recording may be made either in the form of a positive which is almost completely exposed throughout the sound-track area, or in the form of a negative from which prints can be made for reproduction. The sound-track is divided into two parallel sections, each being exposed on only one-half of the sound wave. One portion of the sound-track is then a record of negative half-cycles, and the other of the positive half-cycles.

For silent intervals, there is practically no exposure when making positives. No biasing system is required, as with the noiseless recording systems used at the present time; it will still be required for making negatives from which release prints are to be made.

In reproduction, the light on each track is impressed upon separate photo-cells or separate cathodes of a single cell. The cathodes are connected to opposite ends of a transformer winding. Imperfec-

(*Continued on page* 22)

Trouble Charts Enable Quick Equipment Repairs

By A. C. SCHROEDER

MEMBER, I. A. PROJECTIONIST LOCAL 150, LOS ANGELES, CALIF.

PREPAREDNESS in the projection room very often is not thought of until old man trouble sneaks up on us and raises the devil. Something goes wrong, and then we find that our memory has gone back on us. Which fuse is the one for the exciter lamp circuit? which contactor is the one for the Number 2 machine? or in what part of the circuit is the attenuator?

When checking circuits and apparatus we say to ourself that we know just where everything is; but did you ever put something away and then a few days later be unable to remember where it was? The answer to all this uncertainty is a set of charts, covering everything in the projection room, and some things outside, but closely associated with it, such as grids for the arcs, batteries for the amplifiers, motor generators for the amplifiers and for the arcs, etc.

Some of these charts accompany this article. Yours will not be exactly like these, but they will be similar. If you should make up a set to fit your room, do not say, "I'll remember this, so there is no need of putting that down here." You probably *will not* remember it when the hour of need arises. They are alright if you are *sure* that you will know what they stand for a year, or even three months, from now.

Even when there is no trouble, but changes in the wiring or the equipment are contemplated, a set of drawings will often pay for themselves in the time saved in planning the work. It will not be necessary to chase everything out to "see where this goes" and "where that goes." A glance at one or more drawings will show these things at once, and often will bring things to mind that save time and money by having all needed material on the job before starting, or at least ordered and on the way so it will be handy when ready for it.

Material Shortage

Imagine planning and starting a job and then being without some needed material. The next day (sure, most of our changes are made between 12 midnight and 8 or 9 a. m.), the needed stuff is ordered, but we are informed that it is not obtainable in town and must be ordered from some other city! Well, if you are a cussin' man, this is the time to demonstrate such talent.

In Figure 1 we have the general wiring of the projection room: lights, machine motors, dowsers, etc. You can make your drawings with more detail or you can leave some of it out. For instance, the wiring in the fuse panel can be shown, or it can be drawn in outline only, as in this figure. On the other hand, the three wires for each dowser can be shown just by one line, to show what parts are connected, since we know that it takes three wires to operate it.

The panel in your room may not have all the circuits as shown here. The battery charger, 42 amplifier, and M. G. set for the horn field supply may be fused outside the room, or there may be another panel in the room to take care of some of the circuits. Then, again, your panel may have all these and many more. There may be three machines, curtain controls, and even house lights.

If your outfit has a motor control cabinet, show that, and don't forget that there are fuses and a switch in the box.

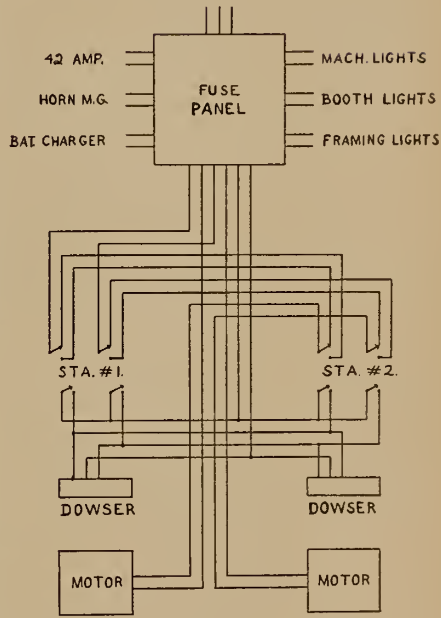


FIGURE 1

Some installations have the switch cut out, some may have the fuses cut out, although I have never seen that. Some have a door switch on the box. Make a note of these things or show them in the drawing.

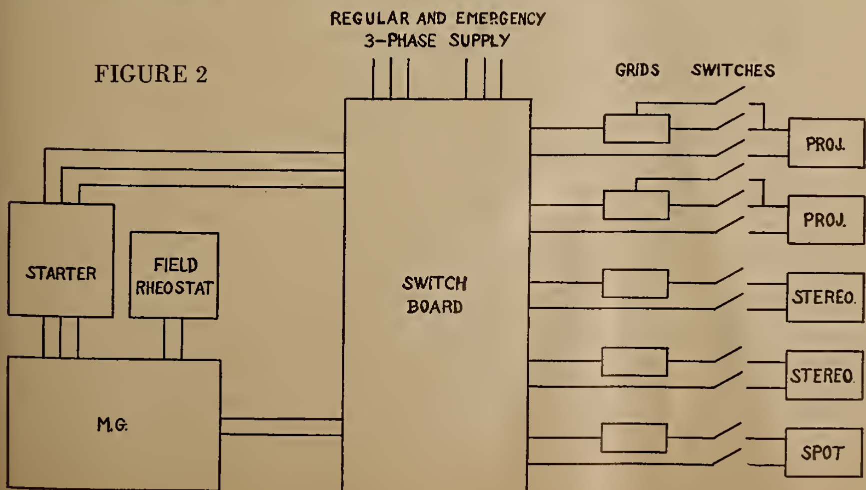
Whatever circuits and equipment you may have and however it is arranged, make your drawings neat and accurate. Notes and lettering should be legible and give all information that may be required. You need not be a draughtsman to make neat and understandable drawings.

Projector Arc Circuits

In Figure 2 we have the arc circuits and their supply. Here again there may be many variations. Possibly you have no emergency supply, or you may have a gas engine for this purpose. Where I work we have the regular set running on 220 volts, while for emergency and for stage shows we use an enormous generator (that is, enormous for a picture theatre) the motor of which runs directly off the 2300-volt supply. The other end of the generator is coupled to a large Winton stationary engine through a dog clutch. Anything of this sort in your theatre could be in the drawing.

Maybe you use a mercury-arc rectifier, or one of the new copper-oxide rectifiers. Some houses use DC right off the lines. I have even heard of one house that used 500 volts DC, breaking it down by the

FIGURE 2



use of grids. What a dish in case the projectionist should happen to trim his lamp with the switch on! Wow!

Then there is the case of the Mazda lamp and its associated equipment. I wonder if there are any of these lamps running on DC? I ran one of them in France, with 32 volts of storage battery and a Delco light generator and gasoline engine, all mounted on a truck.

The switchboard can be shown in your drawings merely by a rectangular outline or the circuits, and switches and fuses can also be shown. Many variations are possible in the arcs, switches and resistance grids. Maybe you use a mercury-arc rectifier and "steal the juice" when changing from one machine to the other. In one theatre years ago I warmed up the machine on AC and on the change-over a husky rope hanging from the ceiling was given a lusty yank, at the same time freezing the carbons on the incoming machine. The rope threw the switch that cut the incoming machine over from AC to the rectifier, and freezing the carbons stole the juice from the other lamp. No, it wasn't my idea; someone rigged it up before I got on the job.

The Speech Circuits

In Figure 3 we have the speech circuits of the sound system. In this department there are probably as many possibilities for variations. RCA and Erpi both have numerous types of equipment in the field, and nobody knows how many other makers there are, many of them probably having put out only a dozen or so outfits.

You will want to make another drawing of the stage horns, showing the speech circuits and also the field circuits and their supply. Another chart should show the supply circuits for the amplifiers, 110 volts (or 220, if such is the case) 12 volts, and the B battery circuits, or maybe it is an MG set or a power pack.

Have you a little P. A. (public address) system in your house? Make a drawing for that. There will probably be separate B batteries for the microphone amplifiers, the 41 will no doubt gets its B current from the second 350-volt terminal in the 42. Then there is the matter of microphones. Carbon mikes use only a low voltage, the condenser mike needs the low voltage for the amplifier associated with the mike, and they need a high polarizing voltage for the mike itself, besides a high voltage for the B current to the amplifier tubes. The dynamic and the ribbon mikes need none of this, since they carry only the speech currents. The mixer also has nothing but speech currents.

Figure 4 shows the B batteries for the Pec amplifiers. In this same drawing might be included B batteries for the

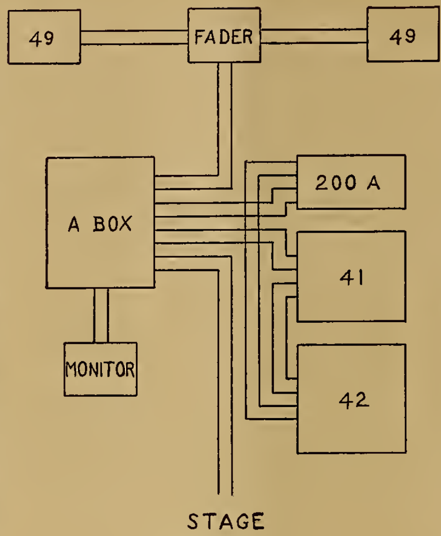


FIGURE 3

P. A. and also for the volume indicator, which is usually present where a P. A. system is operated.

The charging panel is the center of attraction in Figure 5. I have found changes in the hook-up of the batteries in quite a few houses, and possibly your batteries have had some such treatment. This must be noted, and the actual wiring may not be at all like it is shown on the door of the charging panel. It looks as though this panel will soon become a thing of the past, as the batteries are slowly but surely moving out of the picture. And who cares? A tungar "A" supply or an MG set is a whole lot less trouble. I prefer the tungar outfit, because I don't care for the racket of the MG set.

There are other things that may be included. Dimmers might be located immediately above the room, with the control rods coming down through. The switches for the dimmers may be on the front wall of the room. Then again there may be switches back on the stage, so arranged that the lights will be controlled either by dimmers on the stage or the dimmers in the projection room.

The dimmers or lighting circuits may be controlled by contactors set behind the board, or somewhere else in the house. It may be a pre-set board, and a few theatres can boast of the thyratron control.

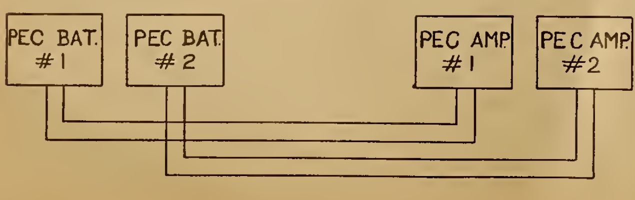
Well, it looks like we have covered most of the things likely to be encountered. The actual material to be included on your drawings depends on what you have and how much you want to put down on paper. I hear a noise from my "monitor" in the kitchen that sounds something like why don't I make a chart for the ironing cord! Good night.

Erpi Marks Time On New Service; Fights RCA

TRADE press reports to the effect that Erpi will not press establishment of its all-inclusive theatre mechanical service for the balance of the summer are directly contrary to field reports that work on this project is being pushed by both Erpi and RCA, with each company bidding on maintenance of the other's sound equipment.

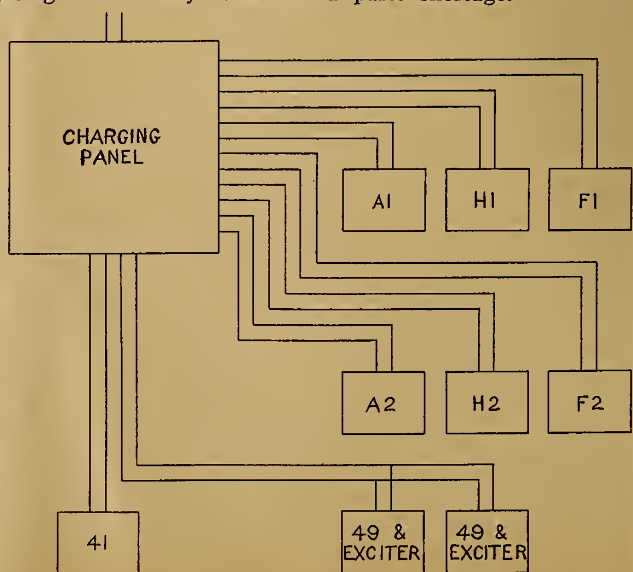
Preliminary tests of the new service which have been and are being conducted in various types of theatres are reported to be inconclusive, so far as concerns establishment of the service as a permanent branch of Erpi activity, according to a *Motion Picture Daily* statement credited to an Erpi official. This same publication also credits Erpi with intending to continue experimental servicing through the summer, with a decision as to its adoption or abandonment due early in the fall.

Meanwhile the field is witnessing a merry battle between Erpi and RCA for control of servicing operations. RCA is understood to have been forced to competitive service bids on Erpi equipment because of the latter's move to encroach on RCA installations. The real test of strength will come when either of the sound companies decides to either delay delivery of or shut down altogether on parts, thus leaving each other with service contracts which cannot be fulfilled because of a parts shortage.



Left: FIGURE 4

Right: FIGURE 5



News of the Month

Brief mention of men and events associated with the motion picture industry of particular interest to projectionists are published here.

Eugene A. Lauste Dies

Eugene A. Lauste, credited with obtaining the first patents for a complete sound-on-film reproducing system in 1906, died recently at the age of 78. When only 23 years of age Lauste held fifty-three French patents. He worked with Edison in 1887, and a year later conceived the idea of reproducing pictures and sound simultaneously. His British patent on this system was granted in 1906, and since then has had the greatest number of reprints of any patent in that office.

Lauste also played an important role in the development of the motion picture projector in the form it is today. In 1895 he projected in New York the pictures of the Griffo-Barnet fight. During recent years Lauste was a consultant for Bell Telephone Laboratories, in which capacity he figured importantly in sound picture patent litigation.

I. A. Takes Over L. U. 143

St. Louis projectionist Local Union 143 has been taken over by the International Alliance pending the outcome of a searching investigation into the affairs of the Local to be conducted by Vice-president John P. Nick and Representative Clyde Weston, who were appointed by President George E. Browne.

Messrs. Nick and Weston will exercise full control over L. U. 143 until the investigation is completed and a report rendered.

S. M. P. E. Fall Convention

The Fall Convention of the Society of Motion Picture Engineers will be held at the Wardman Park Hotel in Washington, D. C., October 21-24 inclusive. The convention program—including papers, exhibits, and entertainment—is now being formulated by the various committees.

Lauds Projectionist Help

Self-explanatory is the following excerpt from a recent letter to Gordon S. Mitchell, manager of the Research Council of the Academy of M. P. Arts & Sciences, to the editor of I. P.:

"One angle which might be of personal interest to you is the reaction to the questionnaire from the projection field. As stated previously, we had chosen a list of several thousand theatres at random from the year books. Our previous experience indicated that we would receive a very small number of replies from the projection field, which has always had the name of being only slightly interested in such matters.

"Since the questionnaires were mailed, however, we have been receiving on an average of 100 to 150 replies by each mail, almost all of which indicate a wish for the information we contemplate sending out. This is indicative of a praiseworthy spirit among the projection craft."

The questionnaire referred to is the first step in a campaign by the Academy to effect closer coordination, through exchange of information and views, between the production and theatre fields. The plan was described in detail in these columns last month.

Local 306 Autonomy

Local Union 306 (N. Y. City projectionist) has regained its autonomous status as a result of an election of officers conducted by the I. A. on July 24. Joe Basson was elected president and Jack Kiely was named N. Y. business agent in a poll which registered more than 1400 votes. The I. A. will transfer complete control of the Union to the incoming officers at once, after being in command for exactly a year.

RCA Projection Booklet

RCA Photophone has issued a booklet describing its High Fidelity sound reproducing equipment, directed particularly to the projectionist. Preceding much interesting technical data is a foreword by President George E. Browne of the I. A. in which he commends this cooperative gesture toward the craft. Copies will be distributed generally by means of the RCA field service staff, although orders from individuals will also be honored.

Negative Costs to Rise

A rise in production costs of from ten to twenty per cent is forecast by the Wall Street Journal for the film season 1935-36. The financial journal contrasts this jump in costs with repeated assurances from picture industry officials that studio costs must, and would be, revised downward in order to come into line with decreasing box-office income. One company alone, M-G-M, is reliably reported to be planning the expenditure of a million dollars on each of six pictures during the coming season, and another three-quarters of a million on six other releases.

RCA-Sonotone Deal

Arrangements have been completed between the Sonotone Corporation and the RCA Manufacturing Co. whereby the latter company will act as exclusive distributors for the sale of a bone-conduction oscillator device for the hard-of-hearing, to be known as the RCA-Sonotone. Sonotone will continue to market its device in the non-commercial field.

Under the agreement, RCA Photophone will sell and install the RCA-Sonotone Oscillator in all theatres regardless of the make of the sound reproducing apparatus in use. In RCA-equipped theatres the new hearing aids will entail the use of a special amplifier, connected with the main reproducing amplifier, and double plug-in boxes placed beneath the arm of the seat-chair. In competitively-equipped theatres, a microphone, to be placed directly in front of the loudspeaker, is also necessary.

The oscillator itself is scarcely larger than a lump of sugar and rests comfortably out of sight behind the ear or lightly against the side of the face so that its gentle vibrations may convey the sound through the bones of the head directly to the auditory nerves.

S. O. S. 16mm. Job

S. O. S. Corp. has announced the availability of a new Cinemaphone 16 mm. sound projector which includes complete sound-on-film mechanism, full A. C. amplification (plug in on any 110 v. A. C. line); a dynamic speaker, 65 feet of cable from amplifier to speaker —all contained in two handy carrying cases each weighing less than 35 pounds.

Detailed operating instructions and other technical data are contained in a book which accompanies every projector.

Projectionists Held Liable

Projectionists are jointly liable with exhibitors in Maryland for failure to show the approval seal of the State Board of Censors, according to a recent ruling by State Attorney-General Herbert O'Connor. Projectionists throughout the country are known to have been taking extreme liberties with both code and state censorship seals, either because of slack work or a personal preference on their part to avoid the "cold" opening of a seal.

Sol Rosenblatt on Own

Sol Rosenblatt, formerly division administrator and also national compliance director for NRA, has opened a law office at 630 Fifth Avenue, N. Y. City. His associate will be William B. Jaffe, formerly with Columbia Pictures Corp.

Weston Analyzer for Sound System Tests

A selective analyzer which meets the servicing requirements of motion picture sound equipment, public address systems, and other electron tube amplifiers is now available from the Weston Electrical Instrument Corp., Newark, N. J. The analyzer is essentially a combination of milliammeter, voltmeter, and ohmmeter, with a wide selection of ranges to reveal circuit characteristics while the equipment is in operation. Two types are offered, one providing range selection by means of pin-jacks, and the other by means of a master switch.

The metering unit is used in combina-

tion with one or more socket selectors; the 50-watt selector, for example, being utilized with the 50-watt amplifier tubes frequently found in sound equipment. Since these socket selectors may be inexpensively obtained for both present and future types of tubes, analyzer obsolescence is practically eliminated. In use, the socket selector block is mounted on the analyzer by means of two pin terminals.

REPRODUCTION AND COLOR FEATURE S. M. P. E. REPORT

(*Continued from page* 18)

tions in the tracks affecting both in the same way are balanced out. This eliminates distortion which might otherwise be present if reproducing from an original recording.

The volume range with this type of recording is 55 db. without audible background noise, when used with systems having an effective frequency range to 9,500 cycles. Only minor modifications of present recorders and reproducers for rerecording are required to utilize this system.

High Fidelity Gains

RCA Photophone announces that theatres have continued to install their High Fidelity equipment. There are over 1,000 installations in the United States. The later musical recordings having a greater difference in the recorded level of speech and music, and requiring a greater gain in power output for adequate reproduction, are impressing upon exhibitors the need for improved reproducing equipment that is free of system noise at the higher gains required and capable of reproducing loud passages without distortion.

The same company announces also that

QUALITY

Theatre Sound Equipment

WITHOUT PRICE PENALTY!

As the World's Largest Independent Manufacturer of Theatre Sound Systems, this friendly organization has built its reputation on—

1. Reliable Equipment
2. Lowest Prices
3. Unexcelled Service

All your needs down to the smallest part can be supplied at this one source.

Literature on Request

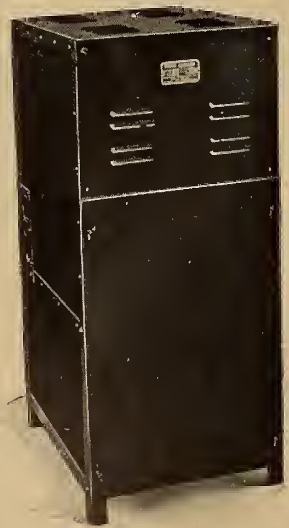
S. O. S. CORP.

1600 Broadway New York, N. Y.

Have YOU *Seen It?*

THE FOREST TWIN 50

COPPER OXIDE RECTIFIER



FOREST TYPE TWIN 50 C-O RECTIFIER

—employs the copper oxide units, insuring long life and quiet, trouble-free and efficient operation—all with a maintenance cost that is nil.

For 2 Projection Arcs - -

AND A SPOT!

LIST PRICE: $500

- FOREST Twin 50 is the ideal power supply for TWO Suprex arcs, of 30 to 50 amperes each. It will also supply a 30 to 60 ampere regular carbon arc Spot Lamp, 50 to 55 volts.
- SEE your dealer today, or write to us for detailed information about this up-to-the-minute rectifier development for modern projection arcs.

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a new stage speaker has been made available for theatre use. It is especially suitable for theatres giving stage performances, because the entire assembly can be flown with the screen. In all installations it is especially convenient; in many installations, the assembly can be placed directly upon the floor behind the screen. When it is necessary to elevate the speakers for proper sound distribution, the assembly can conveniently be placed upon a simple platform. The speaker assembly consists of a large folded horn for reproducing frequencies below 125 cycles, and two or three small speakers or directional baffles for the range from 125 to 9,500 cycles. The large folded horn serves to support the smaller units, which are hinged to the large horn in such a way that they can be conveniently tilted to the required angle.

H. A. DeVry, Inc., announce a projector "made from the ground up" for *both* sound and picture. The DeVry engineers have designed both picture and sound mechanisms as a unit, and have thus been able to eliminate many unnecessary parts. The silent-chain drive is substituted for meshed gears; rear barrel shutter is incorporated in the stock equipment, and the Robertson flywheel is utilized for filtering out vibrations.

The unit is furnished in several models, for Mazda lamp, or for either high- or low-intensity arcs. All machinery is enclosed in a dust-proof metal case, the projector presenting a handsome streamline effect from floor to magazine. Controls are accessible, however, from the outside. The unit may be used in the largest as well as in the smallest theatres.

C. O. Projection Rectifiers

General Electric and the Forest Mfg. Corp. has produced a three-phase full-wave copper-oxide rectifier for supplying power to the projector arcs in theatres. Two sizes are available. The smaller is designed for use with the 6- and 7-mm. trim and will deliver 40 to 50 amperes at an arc voltage of 30 to 35 volts. The larger unit is designed for the 6.5- and 8-mm. trim and will deliver 50 to 65 amperes. These ratings are in accordance with the standards established by the Projection Practice Committee of the S. M. P. E.

The over-all efficiency of either of these units is better than 70 per cent. According to findings of the Projection Practice Committee, the high efficiency of the polyphase type of rectifier will show a saving of 5 to 10 cents an hour in the cost of current as compared with other types of power supply. This means that the rectifier will pay for itself in one or two years in current saving alone.

The Morelite Company, Inc., of New York have placed upon the market a reflector arc lamp called *Sun-Lite Model D*. It is claimed that this lamp gives steady and uniform screen illumination in spite of the sensitiveness of the Suprex copper-coated carbons employed.

The Projection Practice Committee has proposed the use of glass mirror guards as a means of preventing loss of light due to reflector pitting in reflector arc lamps.

For 35-mm. projection in small theatres and auditoriums there has recently been developed by General Electric a 2100-watt, 60-volt projection lamp, containing a bi-plane filament and the new bi-post base. This lamp gives the highest screen illumination attainable with any filament lamp in the 35-mm. projector and gives more than double that of the heretofore generally used 900-watt, 30-ampere projection lamp.

With rims and spokes of clock-spring steel, DeVry has manufactured a 2000-foot film reel, which will not remain bent under pressure or blows, and consequently saves the life of film by its permanent, true alignment. A novel feature is the sliding attachment of the spokes to the hub which allows expansion under strain and prevents warping, dishing, etc., common with the usual reel. Automatic clipping is accomplished by wells in the hub. The projectionist merely presses the film slightly over the well with the finger. Prongs catch the perforations automatically with a non-slip grip.

The release print situation in this country remains decidedly spotty. It is quite apparent that producers do not take the release print seriously. This is a regrettable situation because, after all, the public sees only these prints. Further educational work to impress producers with the necessity of giving the release print more attention is in order.

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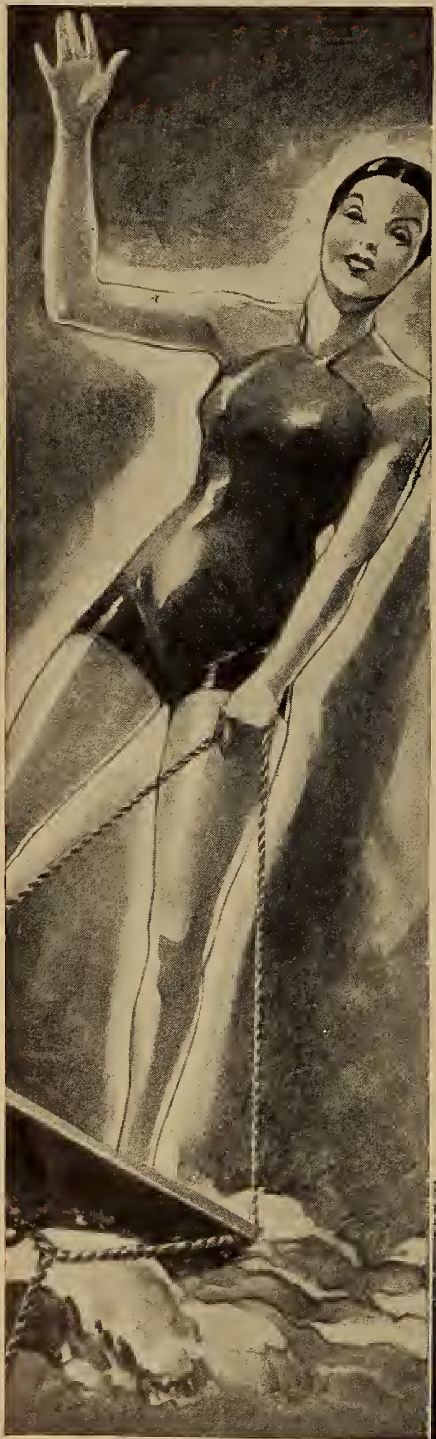

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DEVELOPMENT OF THE MOVIE PROJECTOR

(*Continued from page* 12)

and an inventor, who was the president and general manager of the Mutoscope and Biograph Co. Together Mr. Kennedy and Mr. Marvin, after holding consultations with all interested parties, formed a stock company to take over all valuable patents in the art, the stock to be distributed to the patent owners. It was a closed corporation, the stock was placed in escrow, and none of it was sold.

This holding company was called the Motion Picture Patents Co., and the principal beneficiaries were the Edison Co., the Biograph Co. and the Armat Moving Pictures Co. I owned most of the stock in the latter. The Motion Pictures Patents Co. was an immediate success. The royalties that it collected put no burden upon the industry but resulted in a large net revenue to the Patents Co. A royalty of half a cent a foot was paid by the producers, and a royalty of two dollars a week was paid by the exhibitors to the Patents Co.

At the date of the organization of the Patents Co. there were in this country between ten and twelve thousand small theaters, or *Nickleodeons*, as they were called. The royalty of two dollars a week was an entirely negligible sum to them, but, as it was collected without cost to the Patents Co. by the simple expedient of having the distributors add two dollars a week to their weekly film rentals, it amounted to a practically net revenue of between $20,000 and $24,000 a week. The revenue of half a cent a foot as film royalties also amounted to a handsome total. Unfortunately for the stockholders of the Patents Co., its life was rather a short one.

Some of the producers, for reasons that I have never quite understood, were refused licenses by the Patents Co. These producers, calling themselves "Independents," formed an organization and put up an all-around fight. At that date anything that smacked of being a monopoly or trust was very unpopular with the public and the courts.

The Independents charged the Patents Co. with being an unlawful monopoly under the Sherman Anti-Trust law, and instigated a suit by the Government against them on that ground. In a decision by Judge Dickinson it was held in substance, as I recall it, that while a patentee had a legitimate monopoly within his patent claims, he could not,

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under the Sherman act, lawfully combine his patent with other patents, and the Patents Co. was ordered dissolved.

I have always felt that Judge Dickinson was influenced in his judgment by the fact that the Edison Co. (under the domination of Gilmore) had sold thousands of projection machines without restrictions as to their use, in some instances guaranteeing the right to their use, and, later, through the Patents Co. participated in royalties collected for their use.

Judge Dickinson said, "Every theater was required to pay royalties for the use of projection machines, even where the machine had been owned before the combination was formed." He appeared to overlook, or to ignore, the fact that the machines had been sold without license or other authority from the owners of the projection machine patents.

I have always felt that the Patents Co., instead of being an organization in restraint of trade, the thing that the Sherman law was designed to prohibit, was in effect an organization to facilitate trade; for the reason that prior to the date of the Patents Co.'s acquiring the right to grant licenses, under all the controlling patents, no producer or exhibitor could do a legitimate business—that is, a business that did not infringe one or more patents—and the fear of running counter to the patent laws could certainly have had a deterrent effect upon the business of all except those piratically inclined.

Most Important Contributions

Many erroneous statements have been made and published as to when and by whom the first motion picture projection machine was made. To clarify the facts I have been asked several times to list the more or less basic inventions upon which the motion picture industry was initially established, as shown by U. S. Patent Office records. I have been regarded as qualified to do so because of my own pioneer inventions in the art and my connection with the beginning of the industry founded upon them. Subsequently to this early experience I was called upon to testify, as an expert in the art, in litigation under my patents, and later under the Edison and other patents owned by the Patents Co.

There have been a great variety of motion picture projectors, produced under different names, that vary as to their mechanical details but embody all the inventions that may be called basic—basic in the sense that they are necessary for successful projection and have been used since the beginning or near the beginning and are still being used. The following is my list of the eight most important inventions in the motion picture art:

(1) The Edison camera: Patent No. 589,168, dated Aug. 31, 1897. Filed Aug. 24, 1891. This was the first camera employing a perforated film which was given an intermittent motion so that a given number of perforations and a given number of pictures would be intermittently moved, rather than a given length of film. The result was a film having equally spaced, juxtaposed pictures throughout its length. The first practicable motion picture camera ever produced.

(2) The Edison motion picture film: Patent Reissue No. 12,038, Sept. 30, 1902. Filed Aug. 24, 1891. The first perforated motion picture film ever produced having equally spaced, juxtaposed pictures, necessary to successful motion picture projection and an essential part of every motion picture projector in use the world over today. This Edison film when first made some

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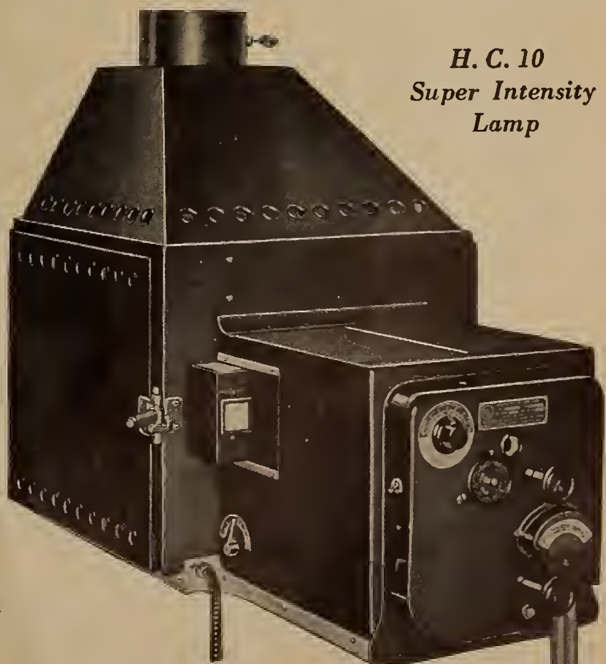

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time prior to 1891 was 1⅜ inch wide over all, contained four perforations to each picture, the picture itself being 1 inch wide by ¾ inch high. The number of perforations per picture and the film dimensions have not been changed in standard size machines since they were first made by Edison some time prior to 1891.

(3) The Edison peep-hole kinetoscope: Patent 493,426, dated March 14, 1893. Filed Aug. 24, 1891. This was the first motion picture exhibiting machine employing a perforated film with equally spaced, juxtaposed pictures. The first practicable motion picture exhibiting machine of *any* kind, but incapable of projecting pictures successfully because it gave the film a continuous motion instead of an intermittent motion.

(4) The Jenkins and Armat intermittent motion projection machine: Patent No. 586,953, dated July 20, 1897. Filed Aug. 28, 1895. The first motion picture projection machine giving the pictures an intermittent motion with a long period of rest and exposure. A mechanical failure, it nevertheless demonstrated the necessity and value of long exposure, essential to successful projection.

(5) The Vitascope: Invented and patented by Thomas Armat, Patent No. 673,992, dated May 14, 1901. Filed February 19, 1896. The first projection machine employing a loop-forming means and the first projection machine embodying a practicable intermittent movement giving the pictures the required long period of rest and exposure. A loop-forming means is essential in projection machines employing a long length of film.

(6) The star-wheel intermittent movement: Invented and patented by Thomas Armat. Patent No. 578,185, dated March 2, 1897. Filed September 25, 1896. By means of this intermittent movement a small sprocket carrying the film could be given a gradually accelerated intermittent movement without film wear and tear and without jar to the mechanism. This movement superseded all others by 1897, and has been continuously used up to date. The intermittent movement is called the "heart" of the projecting machine.

(7) The Albert E. Smith framing device: Patent 673,329, dated April 30, 1901. Filed March 15, 1900. This device frames the pictures while the machine is running, and is a practically essential device.

(8) The John A. Pross shutter: Patent 722,382, dated March 10, 1903. Filed January 19, 1903. An important improvement for reducing scintillation or flicker. Not so essential in the earlier days of 1895 and 1896 when Edison films were the only ones obtainable, since these films were taken at approximately forty per second, but quite essential with pictures taken at the later commercial lower rates.

The foregoing is a complete list of the pioneer inventions covering all the essentials of the motion picture camera, the motion picture film, and the motion picture projector, and they are all in universal use today in the most modern and up-to-date equipment. The addition of color and of sound accompaniment belong to a later period.

Camera-Projector Differences

For the possible benefit of those who have not investigated the matter, I believe it might be well to point out some of the differences between a camera and a projection machine, from the patent and invention standpoint. These differences were pointed out by me in the Patent Office interference in which my Vitascope patent, No. 5 on the list, was involved.

I am not an attorney, but my familiarity with the art and its requirements enabled me to conduct this case successfully myself, preparing the brief and arguing the case personally before the several tribunals of the Patent Office and the Court of Appeals of the District of Columbia, all of which tribunals accepted my views and decided in my favor.

In taking a picture of an object in motion it is essential to make the exposure of the image on the sensitive film as short as possible, consistent with the sensitiveness of the film, for the reason that if this is not done there will be time for the image of the moving object to be displaced on the sensitive film, causing a blurred or indistinct picture. In an exhibiting apparatus the reverse is true. There is, in the exhibiting apparatus, a picture fixed beyond the possibility of any such image movement's causing blur, and the longer the picture is exposed to the eye, the better the results.

In a camera we are dealing with a moving object and a sensitive film. In an exhibiting apparatus we are dealing with a fixed picture and the human eye. No question of flicker or scintillation enters into the problem of taking pictures. That question enters very extensively into the problem of exhibiting pictures.

In a camera, the sensitive film does not cooperate with the mechanism to produce a complete or final result. The film has to be taken out, and developed and printed before the operation is complete. The film is run through the camera but once. The Patent Office and the Courts held that the film is no more a part of a camera than the paper is of a printing press. In an exhibition machine the film with pictures on it is an essential part of the apparatus. It is a part of the mechanism which cooperates with the other parts to produce the complete and final results. In an exhibition machine the film is used over and over again in the apparatus and has to be so used whenever the apparatus is used. In passing upon this question the Patent Office had this to say:

> "If Latham with his Exhibit Machine No. 12, and Casler with his Exhibit First Machine, both of which were taking cameras, could, without invention, have produced a machine of the construction called for by the issue, it is remarkable that they did not do so at any proven date before the filing of their application.
>
> "The evidence shows that neither Latham nor Casler was an ordinary mechanic but that they were inventors of considerable capacity, and yet neither of them produced a machine having the new and beneficial results which are claimed for the machine described in Armat's application."

The Patent Office said further:

> "In our opinion, proof of the existence of a camera for taking pictures of an object in motion, said camera having in combination with a sensitive film, mechanism for giving the film an intermittent motion in which the periods of pause exceed the period of motion, said mechanism comprising in addition the other elements called for by the issue and a shutter, is not a reduction to practice of this issue; unless there is proof to show that when this camera was used for projecting the shutter was either omitted altogether, or was so adjusted as to provide for such relative periods of pause and illumination and periods of motion as are called for by this issue."

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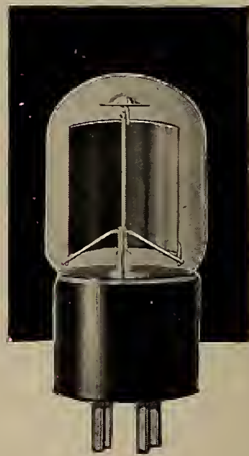

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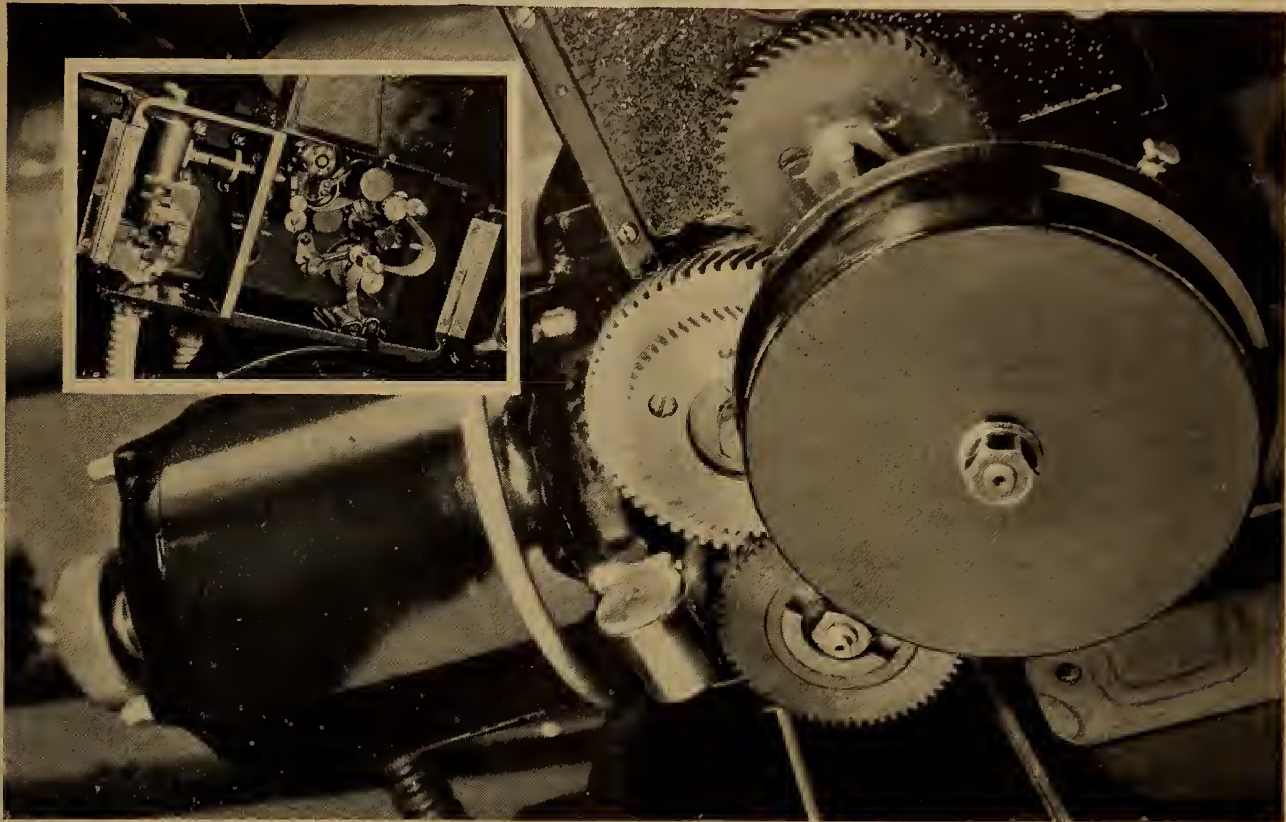

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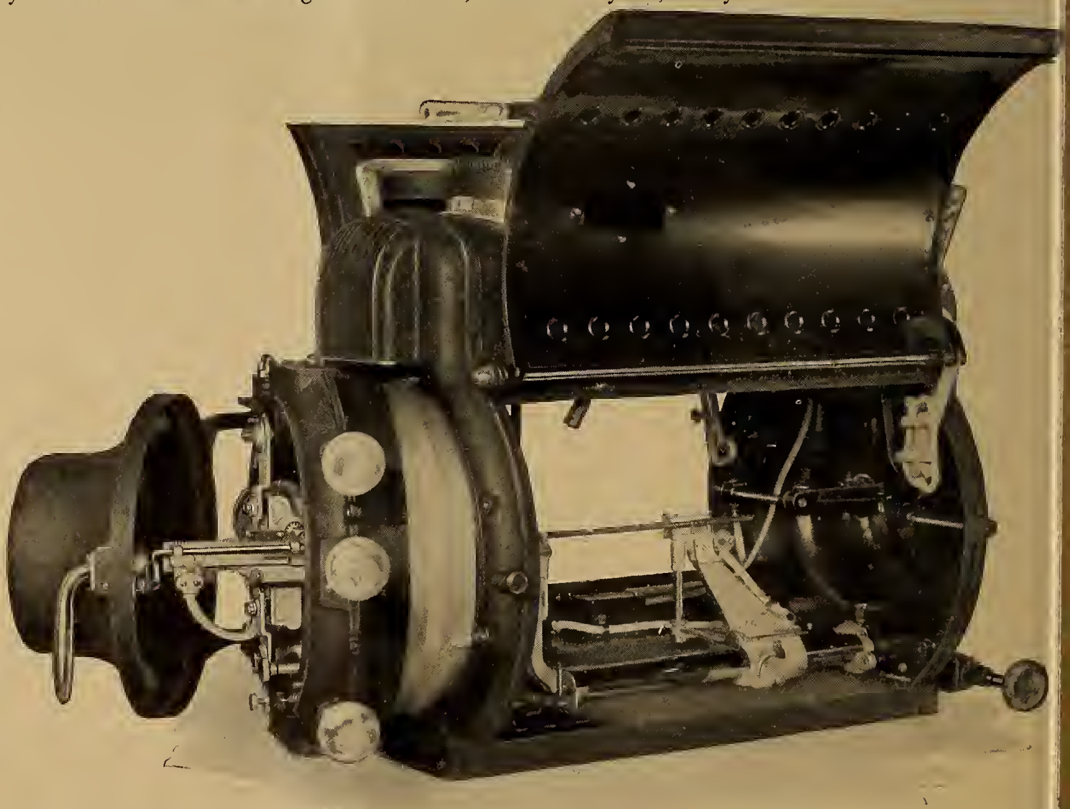

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Index and Monthly Chat 5

Step-By-Step Analysis of Sound Reproducing Equipment, XIII 7
AARON NADELL

Projections 10
FRANK DUDIAK

Purchasing Pointers on Modern Projection Room Equipment 12
M. L. ROBINSON

Newsreel Sound Quality is Greatly Improved 13
J. A. BATTLE

Super-Speed Camera Takes 1200 Full Frames Per Second 14
HORATIO W. LAMSON

Uniform Print Density is Promised Soon 16

Good Projection a Vital Industry Necessity, Says Cecil B. De Mille 16

Academy Double-Reel Proposal Discloses Several Inherent Defects 17
JAMES J. FINN

I. P. Service Department 18

It's Not the Heat—It's the Humidity 18

The Kodachrome Process For Natural Color Cinematography 19
L. D. MANNES
L. GODOWSKY, JR.

News of the Month 21

News Notes

Technical Hints

Miscellaneous Items

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MONTHLY CHAT

THE anticipated squawking from the field anent the imminent arrival of double reels as an industry standard materialized with a bang. Strangely enough, the technical aspects of the situation were accorded scant attention by the rabid penmen, who viewed the projected standard as a new form of grave social injustice. A few correspondents gave us the old hokus-pocus about increased fire hazards and all that sort of thing, and a few others tried valiantly to prove that the projection process would suffer grievously.

To all of which we reply that the double-reel standard could be seen coming down the road for, lo, these many years, and nobody in the craft was the least bit concerned thereat. As we said last month, now is the time to take it and like it—but take it we must.

DRIFTING down the wind come opinions to the effect that the market for Suprex lamps is "pretty well washed up"—with which statement we are in complete disagreement. We hold that the Suprex market is just opening up on a really large scale. The next step will be to 9- and 10-mm. Suprex carbons, and from there on upward. The present Suprex lamp design undoubtedly will have to be modified for the higher amperages certain to be used; but the basic Suprex idea will continue rolling along.

OUR dear friends the "electrics" are instructing their field men in the intricacies of operating the theatre plant—including the projection room and stage—via the bulletin route. Wait until the I. C. S. hears about this encroachment on its jurisdictional rights.

NOW is the time to make that last desperate stab at some new equipment for that old room. With a new season opening, the boss probably feels as good as he ever will over the prospects of sharply increased grosses. The projectionist's job is to know about the important savings that can be effected with various new equipments—particularly lamps and powering units—and to communicate this knowledge to the owner or manager. Bear down hard on the dollars-and-cents aspects of the matter.

WE'RE still awaiting the release by the S.M.P.E. of the report of its Projection Committee, presented last May to the Hollywood meeting. The delay is just another indication of the static quality of those hoary old Society rules which evidently are more concerned with maintaining the "prestige" of the organization rather than rendering a service of practical worth to the field. Meanwhile, the Academy continues to reap the benefits of prompt publication of work accomplished.

New G-E COPPER OXIDE RECTIFIER IMPROVES PROJECTION EFFICIENCY

This new General Electric Copper Oxide Rectifier is especially designed to meet the requirements of projection lamps using the new Suprex carbons. It is a rectifying device of proven reliability, safety and economy. The G-E Copper Oxide Rectifier operates indefinitely without attention or replacement. The three-unit transformer for three-phase, full-wave rectification delivers extremely smooth output. Great operating flexibility is provided by line voltage taps and secondary taps for adjustments in line voltage, arc voltage, and current. This wide range of adjustments meets all individual operating needs.

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INTERNATIONAL PROJECTIONIST

VOLUME IX NUMBER 2

AUGUST 1935

Step-By-Step Analysis of Sound Reproducing Equipment

By AARON NADELL

XIII. Western Electric 713-A Control Cabinet

A STEP beyond the control cabinets shown previously in this series is represented by Figure 1 of the present article, which diagrams the connections of a single cabinet containing within itself nearly all the controls and switches for a complete sound system.

The apparatus of Fig. 1 includes (a) switches for providing 12-volt d.c. power to two exciting lamps; (b) rheostats for controlling the power to each exciting lamp; (c) ammeters for reading the current through each exciting lamp; (d) switches (same as above acting upon a different but parallel circuit) for supplying 12-volt d.c. power to the filaments of the p.e.c. amplifier; (e) separate switches to provide 90-volt d.c. power to each p.e.c. amplifier and its associated photo-cell; (f) bull's-eye signal lamps when power switches to either or both of the projectors are closed—these are green lights indicating that the projector in question is "ready"; (g) separate switches to connect the sound output of either projector to the system amplifier; (h) bull's-eye signal lamps (red) to indicate which projector has been switched to "play", and (i) a potentiometer in an L-circuit volume control to govern the sound volume admitted to the system amplifier.

When this control cabinet is used with sound installations of the earlier type, equipped for synchronous disc reproduction, the "film-disc" switch is located at the projector itself, and constitutes part of the W. E. Universal Base.

When Fig. 1 used in connection with non-synchronous reproducing equipment (78 r.p.m. turntables or an announcing microphone) terminals 5 and 6 in the extreme upper left-hand corner of the drawing are not wired directly to the main or system amplifier input, but to a second switching panel mounted on the system amplifier rack. Choice between synchronous sound as drawn from Fig. 1 and non-synchronous sound obtained from other sources, is then made at the "synch—non-synch" switching panel.

Fig. 1 contains within itself all sound and power controls necessary to the average system except those just mentioned, and except (a) the 110-volt switches for the two projector motors; (b) the 110-volt switch controlling the system amplifier; (c) the 110-volt switches to the power supply rectifier or motor-generator, or the storage battery charge-discharge switch; (d) the 12-volt d.c. switches controlling d.c. supply to the amplifier filaments and the speaker fields, and (e) a gain control in the system amplifier that is seldom, and sometimes never, adjusted.

Sound controls not included in Fig. 1 may also be added for switching or modifying speaker voice circuits, especially in the case of wide range.

Figure 1 of this article appears on the second page following.

Exciter Lamp Circuits

At the extreme bottom center of Fig. 1 are two terminals marked "1" and "2". No. 2 terminal is not used. No. 1 terminal is also marked "+12V", and is connected to the positive side of the 12-volt source.

Beginning at Terminal No. 1, the 12-volt circuit to the left-hand, or Red, projector exciting lamp may be traced as follows: upward to the two lower blades of the three-blade, single-throw switch, D-1, shown open in the drawing; when this switch is closed, downward from its two lower points, left and upward to the positive side of the ammeter, M-1. Through this meter to exciting lamp rheostat R-1. From the rheostat left and out to the exciting lamp through Terminal 11; in from the exciting lamp at Terminal No. 12; thence right and down, and right all the way across

the bottom of the drawing, and up to the fourth terminal from the top in the ground strip at the extreme upper right-hand corner. Through the common bond of that terminal strip to the fifth terminal from the top, and thence out to the negative side of the 12-volt source.

The circuit of the White exciter lamp is very similar: from the 12-volt positive input at Terminal No. 1 up, right and up to the two lower blades of the three-blade, single-throw switch, D-2; when this switch is closed, to the two lower points, and thence down, right and up to the ammeter M-2. Through this, and right through rheostat R-2, and out to the sound lamp through Terminal No. 19. Back into Fig. 1 through Terminal No. 20 and upward to the fifth terminal from the top of the ground strip. Thence out to the negative side of the 12-volt source.

Pec. Amplifier Filament Supply

The filaments of the p.e.c. amplifiers are lighted through circuits in parallel with those just traced, but equipped with interesting switch-click filters. The filament current of the Red, or No. 1, amplifier may be traced from positive 12-volt input at the bottom center of the drawing upward to the lower two baldes of switch D-1, thence down and left (continuing left past the junction point from which the No. 1 exciter lamp supply runs upward to M-1 meter) and out to the amplifier at Terminal No. 13. Through the amplifier filaments and back into Fig. 1 at Terminal No. 14; thence right all the way across the bottom of the drawing and up to the fourth terminal from the top of the ground strip in the upper right-hand corner. Through the common bond to the fifth terminal from the top of that ground strip, and out to the negative side of the 12-volt source.

No. 2 p.e.c. amplifier filament circuit is: upward from Terminal No. 1, right and up to the two lower blades of D-2; from the two lower points of that switch down right (past the branch that runs through M-2 to sound lamp No. 2) and out at Terminal No. 21. In at Terminal No. 22 and up to the fifth binding post from the top on the ground strip.

Action of the Surge Suppressors

The two click filters or surge suppressors bridge the D-1 and D-2 contacts that have just been traced. The filter of the Red circuit is drawn just above and to the left of the 12-volt positive input, and consists of a condenser, C-1, and a resistor, R-3. An inch further to the right, R-4 and C-2 constitute the surge suppressor of the white circuit.

These suppressors act to eliminate the click that would otherwise be heard in the speakers when either D-1 or D-2 is opened while the other projector is running. To easily understand how this is done, consider what would happen if they weren't in the circuit: assume that Switches D-1, D-2 are closed, and that D-1 is then opened while the White projector is in operation. Half the load across the d.c. source is abruptly open-circuited, and the voltage of the source rises with equal abruptness. The result is a correspondingly rapid rise in the brightness of the White exciting lamp and in the emission from the filaments of the White p.e.c. amplifier, and a sharp click is heard in the sound.

This is what would happen if C-1 and R-3 were not included in Fig. 1. Consider the identical train of events with those filter components present as the drawing shows them.

Again assuming that both D-1 and D-3 are closed, it is evident that C-1 cannot contain any charge, since it is short-circuited (through R-3) by D-1 switch blades.

Now, if Switch D-1 is opened while the White projector is running, the short-circuit is removed from around Condenser C-1, and that condenser is connected across the d.c. line—not directly, but to positive through R-3, and to negative through the ammeter, R-1 and the Red exciter lamp. It will therefore charge to the full voltage of the d.c. line, and until that process is completed it will draw charging current from the line, and the voltage across the lamp and tube filaments of No. 2 projector will not reach peak value.

The presence of C-1 as connected in the drawing consequently results in a somewhat more gradual increase in the brightness of No. 2 exciter and in the emission of No. 2 tubes, and the switching click is greatly reduced or eliminated.

The time delay involved is, of course, a fraction of a second, but R-3 helps to increase it somewhat. Its resistance reduces the amperage that charges C-1 (amperage is the number of electrons flowing *per second*) and hence, since a definite number of electrons are required to complete the charge of C-1, prolongs the time of charging. In this it is helped to a small extent by R-1 and by the filament of No. 1 sound lamp, but their resistance is very low compared with the 50 ohms of R-3.

Now, if Switch D-1 is again closed, Condenser C-1 is again short-circuited, and gives up its charge through R-3. It has no influence on the click heard (if any) when the switch is closed, since the charge is equalized through the switch blades and has no effect on the voltage of the source. However, the click caused when the switch is closed is much lighter than the one that results from opening the same switch, and often is inaudible.

R-4 and C-2, of course, offer corresponding protection to the sound from Projector No. 1 when that is operating and Switch D-2 is opened.

Green, or "Ready," Signal Lamps

The position of D-1 and D-2 can be determined at a glance from any part of the projection room. If either switch be closed, a green light will show on the same side of the panel. These circuits are closed through the top blades of the switches, and are readily traced:

From the 12-volt positive Terminal No. 1, at the bottom center of the drawing, to the top blade of D-1; from the top point of D-1 left, up, left and up to the left-hand terminal of E-1 "ready" lamp. Through that lamp filament and right, up and right to the top terminal of the ground strip; thence through the common bond to the fifth terminal from the top and the negative return.

The circuit through D-2 is from the 12-volt positive input up, right and up to the top blade of that switch; from the top point of the same right, up, right and up to the left-hand terminal of E-3 "ready" lamp; through this and down, right, up and right to the ground strip and back to the negative d.c. source as before.

90-Volt D. C. Circuit

The positive side of the 90-volt source, which biases the anode of the p.e cell and the plates of the p.e.c. amplifier tubes, is wired to Terminal No. 3 in the upper left-hand corner of Fig. 1. Thence right to the center of the drawing, and down to the point where the line branches to two switches, D-4 and D-5. Tracing through D-4, the circuit continues up and left to Terminal No. 9, whence it runs externally to the positive 90-volt input on the Red projector. Back into Fig. 1 at Terminal No. 10, and right straight across the drawing and then up and right to the second binding post from the top of the ground strip; thence down through the common bond to the third terminal from the top, and out to the negative side of the source.

Returning to the 90-volt positive input at No. 3 binding post in the upper left corner of the drawing, we trace again right and down, but this time right through Switch D-5 and up and right to Terminal No. 17; thence out to the White projector and back in at 18; thence left, up and right to the third terminal from the top on the ground strip, and out again to the negative 90-volt line.

Although their position in the drawing may suggest that D-4 and D-5 are in some way part of D-1 and D-2, and operate with them, this is not the case. The 90-volt switches are entirely independent of the 12-volt switches, and must be thrown separately.

Sound Switching Circuits

There are no bull's-eyes in the cabinet to show when these circuits are closed, and none are necessary, since D-4 and D-5 are commonly left "on" at all times. Their circuits are, in fact, controlled by the positions of D-1 and D-2, since plate current cannot flow in tubes or p.e. cells without emission, and there is no emission in tubes without filament current, or in p.e. cells without exciting light.

Sound switching in this cabinet is performed by the D-3, 704-A switch occupying the upper center of the drawing and consisting of four switch-prong assemblies. The left-hand assembly has three prongs, the next from the left, four; the third from the left, four, and the right-hand assembly, three.

The central prongs of the three-prong assemblies have no wires connected to them and perform no function. They

were originally used herein to short-circuit the output of the projector not in use, but the wiring shown in Fig. 1 proved more satisfactory with systems that used the same B battery for both projectors, and has now been made universal.

Sound Control Switches

The left-hand three-prong, and the left-hand four-prong, assemblies control the sound from the Red projector; the other two assemblies control the sound from the White projector. As shown here, both switches are "off," and both projector outputs open-circuited. The switch lever may be operated to move the long prongs of the two left-hand assemblies to the left, closing No. 1 projector output and leaving No. 2 circuits as shown.

Operated in the reverse direction the control lever restores No. 1 circuits to their present position but moves the long prongs of the two right-hand switches to the left, and closes No. 2 projector output. To repeat, in *both* switches the long prongs move to the left to close, and to the right to open.

Sound output from Projector No. 1 is wired to terminals 7 and 8 at the left of the drawing. From Terminal No. 7 trace to the extreme left-hand prong of the Red three-prong assembly; thence to the long prong of the same assembly and down, right, up, right, up and left to No. 3 terminal of the potentiometer.

From Terminal No. 8 right and up to the left-hand prong of the four-prong Red assembly; thence to the second prong from the left and down, right, up, left and up to No. 1 terminal of the potentiometer.

The potentiometer is therefore switched directly across the 500-ohm output of the projector head amplifier. It consists of 11 resistors with impedances that add up as follows:

15.6	36
6.6	53
9	72
13	104
18.4	146
26	

TOTAL OHMS: 499.6.

The No. 2 projector input is wired to terminals 15 and 16, just under the ground strip at the right-hand side of the drawing. From Terminal No. 15 to the right-hand prong of the White three-prong assembly. Thence to the long prong of the same assembly and right, up and left to No. 3 terminal of the potentiometer.

From Terminal No. 16 left to the extreme left-hand prong of the White four-prong assembly; thence to the second prong from the left, and right, up, left and up to the other side of the potentiometer, Terminal No. 1.

It will be noted that this control cabinet uses a single, not a double, potentiometer, and that there is no *input* connection to its sliding contact, as in the control cabinets previously traced (I. P. for July, 1935). In the present circuit, switching between projectors is done by D-3 switches and not by the potentiometer slider, as in the other two circuits of this series.

There are other prongs to D-3 that have not yet been considered.

Red, or "Play," Signal Lamps

Referring again to the 12-volt positive input terminal at the bottom center of Fig. 1, let us trace up to the top blade of D-1 left through that blade and up, right and up to the extreme right-hand prong of the Red four-prong assembly.

In the drawing this prong is open; the heavy black line leading to the third prong from the right is an insulating stud that causes the two prongs so joined to move in unison. But when this four-prong assembly is closed, the circuit from the 12-volt positive input may be traced further to the second prong from the right, and thence down, left and up to the left-hand terminal of E-2 Red "play" lamp, and through that lamp, down, right, up and right to the ground strip. E-2 will then light and show that the potentiometer of Figure 1 has been switched across No. 1 Projector sound output.

Again tracing from the 12-volt positive input, this time up and right to the top blade of D-2, the corresponding circuit for No. 2 Projector may be followed right, up, right and up to the long prong of the White four-prong assembly, thence (when that assembly is closed) to the arrowhead immediately left of it and down, right and up, through E-4 Red "play" light and up and right to the ground strip.

Switch Sequences of D-3

It will be noted that in both circuits the four-prong assemblies carry the "play" light signal line and one side of the sound line; while the other side of the sound line is closed through the three-prong assemblies. If both sound and signal lines closed and opened together, a click or noise might be heard when this switch was operated for change-over, due to minute sparking at the signal line contacts. To avoid this, the prongs are so arranged and their tensions so adjusted. that the three-prong assembly remains open until after

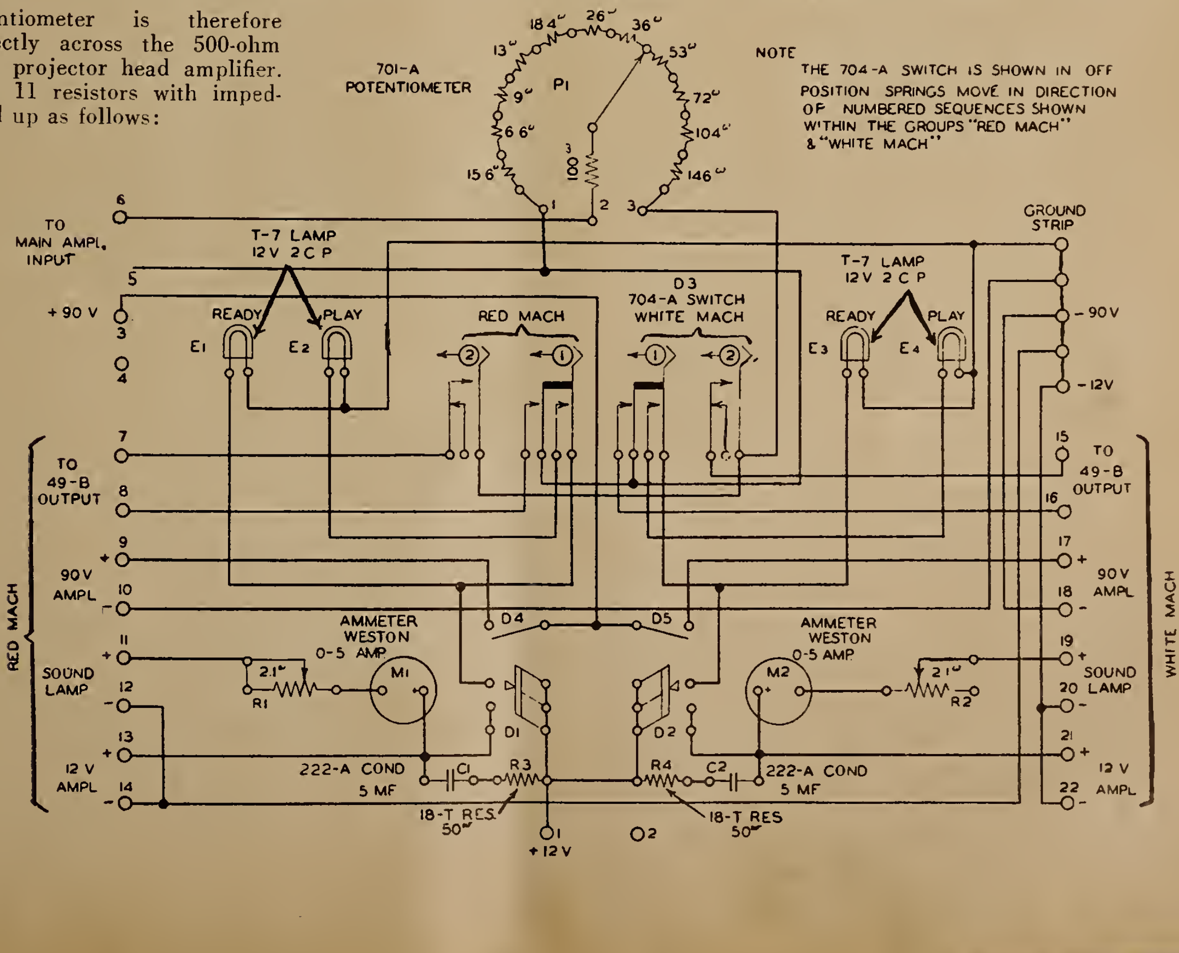

FIGURE 1

the four prong assembly has definitely closed, thus keeping the sound line switched "off" until sparking at the signal prongs in the four-prong assembly is all over. Conversely, when this switch is opened the three-prong assembly opens first, and the sound circuit is definitely "off" before there is any possibility of sparking at the signal contacts.

This adjustment is necessarily very delicate, since the time lag between the operation of the two sets of contacts will be in the order of, perhaps, 1/1,000th of a second, consequently, particular care is necessary in cleaning or burnishing these contacts to avoid upsetting the tension of the prongs. The prongs should never be bent to repair or to improve the operation of the switch unless a special prong tension tool made for the purpose is at hand. Miraculous luck is required to do this job with pliers or fingers.

The Output Circuit

When sound current from either of the two projectors flows through the circle of potentiometer P-1, a potential difference, or voltage drop, is developed which constitutes the source of the sound current supplied to the system amplifier input.

Any desired portion of that potential difference is connected to the system amplifier by means of the potentiometer's sliding contact. The wires leading to the amplifier input are connected to Terminals 5 and 6 in the upper left-hand corner of Fig. 1. From Terminal 6 trace right and up to the sliding contact at Potentiometer Terminal 2. From Terminal 5 trace right and up to Potentiometer Terminal 1.

Obviously, when the slider is set close to Potentiometer Terminal 1 a comparatively small portion of the potential difference across the whole potentiometer is used to cause sound current to flow through the primary winding of the system amplifier's input transformer. When the slider is moved to the other end of the potentiometer, the whole voltage drop developed across its 499.6 ohms drives current through the system amplifier input, and sound volume will be vastly greater.

The 100-ohm resistor in series with the sliding contact provides an "L" circuit that improves the impedance relations. Eleven possible impedances can "look into" the system amplifier input:

FADER POINT	IMPEDANCE
1	115.6
2	122.2
3	131.2
4	144.2
5	162.6
6	188.6
7	224.6
8	277.6
9	349.6
10	453.6
11	599.6

Tolerable impedance match to the 200-ohm input of the system amplifier is obtained, therefore, between points 4 and 8 of this fader; but extreme fader settings, and especially very high settings, should be avoided as far as possible by suitable adjustment of the amplifier gain control.

Projections

By FRANK DUDIAK

MANAGERS spend many dollars on short films lasting about five minutes, but they balk when asked to spend fifty cents a month for non-sync. records used during intermissions and after the show breaks. Week after week the same old discs are played, until the patrons know the arrangement backwards and probably could name every scratch on the record.

Under this policy the records become "chasers" in fact. I know patrons who amuse themselves by making wagers as to which one of three or four records the theatre will use on a given night.

- -

ONE distributor has had great success through the use of the following notice which accompanies all shipments of new prints:

"This is a new Print! It has been properly processed, but can be scratched or damaged by excessive tension on picture aperture or sound aperture; also by guide rollers out of adjustment, etc. To obtain best results, please decrease tension at these points.

"Scratched film can result from any accumulation of dust, dirt or grit on your picture or sound track apertures. Film is also damaged by worn sprockets, guide rollers, etc. Magazine guide rollers and idlers should revolve freely and should be in perfect alignment with the corresponding upper or lower rollers, idlers or sprockets.

"We assume that you want to give your patrons the most satisfactory . . . presentation of this picture, and we ask, therefore, that you eliminate all dirt from your apertures and replace worn parts. We are doing everything we can to please your patrons. Will you help?"

This is all very sweet and inspiring; and if such a schedule is not adhered to, it is not the projectionist's fault. Distributors might well shift their educational attack away from projectionists and concentrate on theatre managers to whom the mere thought of equipment repairs and replacements is anathema.

- -

That red china marking pencil that found its way into the projection room along with sound pictures has proved its worth. It is used everywhere to mark records and cabinets and notably for temporary film markings, particularly for "Start" and "Change-Over" cues.

This pencil marking does not damage film emulsion, and I think that it is largely responsible for a sharp decrease in punch holes, scratch marks and the like. The pencil marks are easily removed after the run.

- -

PROJECTIONISTS are reputed to be great "chinners," and even a group of only three or four can carry on a running discussion, argument or what have you on as many topics simultaneously. It strikes me as strange, however, that the question of projectionist health never comes in for any extended discussion.

This publication has recognized the extreme important of this topic and has published articles intended to awaken the craft to the necessities of the situation and prod them into action on needed reforms. Some years ago many Unions were keenly interested in this topic, but today organization interest in the worker's health is practically nil. This is indeed regrettable, because an organization like the Alliance, for example, could use its group strength, contacts and influence to do good work in this direction.

We all have heard the expression that projection work is confining and conducive to impaired health because of (1) it is confining, (2) room temperatures are very high throughout the year, and (3) carbon deposits are absorbed into the system through the nose and mouth. Insurance rates are very high for projectionists—although here I. P. has done fine work in obtaining lowered rates—and tuberculosis is prevalent.

In view of all this it seems that the I. A. could perform a real service to the craft with no more effort than is required to prepare and circulate among its members a questionnaire which, when answered, would provide valuable first-hand information on craft health and enable a direct comparison with other crafts. Should the Alliance not follow such a course on a national scale, the Local unit could use the following form for its own members:

Number of Men ....
Number Ill ....
Number Bedridden more than Two Days ....
Ailments (List Five in Order of Importance) ....

Possessing such statistics, the I. A., or even the Local unit, could offer telling arguments during negotiations with employers or on legislative matters. Think it over.

ERPI PROFITS SERVICE SPUR

Announcement of Erpi profits of nearly ten million dollars in the last eight years has served to spur bidding on service work by independent groups. Erpi's non-committal attitude toward all-inclusive servicing is believed influenced greatly by the pending Federal probe of Erpi activities in the sound field.

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Purchasing Pointers on Modern Projection Room Equipment

By M. L. ROBINSON

Purchasing data for those who have forgotten and those who want to know, related by a man with twenty-five years experience in selling and servicing projection room equipment.

YEARS of experience in electrical machinery sales and service work, including the handling of much factory correspondence, convinces me that the relationship now existing between buyer and seller could be vastly improved by the application of a little common sense. This is particularly true of the motion picture projection field which, unlike any other business, counts interruption of a program as revenue irretrievably lost. There are no tomorrows in show business.

It is the right of the user of projection equipment, no less than the duty of the seller, that the former be fully informed as to the capabilities of a given unit of equipment—its capacity, installation, maintenance, operation, and last but positively not least, its guarantee of what and for how long a period.

Consumer grievances might be listed as follows:

1. Lack of definite information on the equipment: capacity, operation, installation and special maintenance hints. No written, printed or oral guarantee.
2. Exaggerated statements, made either deliberately or through ignorance.
3. The well-known "commission complex" of salesmen who concentrate on today and forget the tomorrow that may bring equipment trouble, a breakdown and loss of consumer goodwill.
4. Improper installation. Even the best equipment must be properly installed to give good results.
5. Inadequate maintenance. Machines require attention, and particularly those units having moving parts.
6. Poor advice. Show business suffers from a plenitude of "experts" who know nothing about either machinery or the projection art. Difficult though it is to believe, some exhibitors seek "expert" advice on equipments from representatives of competitive lines.

My idea of an ideal situation is that theatre in which the projectionist is given a free hand in all equipment matters and held strictly accountable for the operation and maintenance therefore. The question of competency enters in here, of course, but the fact that scores of theatres operate on this basis simply proves that those who do not do so are missing a good bet.

We are all familiar with the old bromide that the worst enemy of successful theatre operation is a breakdown. Today's business cannot be distributed over one thousand tomorrows, which fact emphasizes the importance of emergency equipment. A great majority of managers abhor the very sound of the phrase "spare parts." Why this is so I have never been able to figure out. These same managers, I assume, wear rubbers on rainy days.

Spare parts should be considered as breakdown insurance, their cost to be considered as the premiums, therefore.

Many theatres have a single motor generator, for example, and nothing else in the way of power supply. A breakdown sets up the following chain of events: loss of revenue, loss of goodwill, costs of telegrams and telephone calls and, usually, overtime charges for quick installation of replacement equipment. All this can easily exceed the cost of spare equipment.

Let us consider an equipment breakdown in a locality where expert repair or maintenance advice is not available (there being thousands of such places). First there is a hurry call to the supply dealer for spares. The latter may have something, but usually the unit will be of the wrong rating. Then there goes out to the manufacturer a wire, often collect, along this style:

MY MOTORGENERATOR DEFECTIVE BURNED OUT SHIP ANOTHER BY EXPRESS IMMEDIATELY MIDVALE THEATRE

Now, the factory may or may not know that one of its dealers sold a generator to this particular theatre. But if it should know, the records will show the capacity, etc., and the length of time the unit has been out in the field. The theatre's financial rating is next determined, and very often this rating is not good enough to warrant shipping on an open account.

The factory can hardly afford to ship a new unit, because it is a certainty that the theatre will return the generator as soon as the old equipment is repaired. Shipping new units on temporary installations means that a factory will soon acquire the reputation of selling second-hand units.

There is no way of knowing whether a generator is defective until it has been examined. Somebody must pay for the transportation and repairs, but the man in trouble never considers this angle. It is suggested, therefore, that the next time you have equipment trouble you send a *prepaid* wire as follows:

MACHINE #635421 BURNED OUT SHIP USED OR NEW REPLACEMENT BY EXPRESS COLLECT STOP RETURNING SET BY PREPAID FREIGHT STOP IF NECESSARY WILL PAY REASONABLE CHARGE FOR USE OF EMERGENCY GENERATOR ADVISE

Such a wire cannot fail to win co-

Excellent example of application of projection background process to modern motion picture production methods

operation. If the trouble is caused by defects, within the guarantee period, repairs are made at no charge. However, it is only fair that the manufacturer receive a reasonable compensation for the use of any replacement machine. Frequently no charge is made in cases where the user exhibits a desire to cooperate fully and play fair.

The tender of a guarantee is in itself sufficient indication that the manufacturer is just as anxious as is the user that the equipment function satisfactorily. Here are some typical guarantees applying to nationally known electrical apparatus:

RECTIFIER BULBS

Adjustments are made under the following conditions:

1. A bulb lights but does not charge; filament shows no appreciable sag.
2. Carbon anode has a blue or a white coating. This is known as an "air leak."
3. Carbon anode stem broken or loose and *showing no sign of use.*
4. Defective weld of filament to stem. Bulb will not light.

No adjustment is made on bulbs under the following conditions:

1. Glass bulb or tip broken or cracked, admitting air, if bulb shows signs of use.
2. Flash-back, which burns off the filament on one side and often burns the tungsten stem due to connecting batteries reversely to the rectifier or to the A.C. line being cut off while too many batteries are charging, without first opening the charging line. Loose or poor contacts to batteries will sometimes cause a flash-back through the bulb. If wires or carbon holders of the projector arc are grounded, it will flash the bulb and destroy the filament.

Bulbs are usually guaranteed for 1000 hours (although they often burn several times this period) and will be replaced as indicated in the foregoing summary.

Rectifiers for arc supply are usually guaranteed against mechanical or electrical defects for a period of two years from date of purchase. Should trouble develop, the unit must not be worked on by an unauthorized person (consent of the factory is necessary) and it must be returned to the factory prepaid. Other typical guarantee forms are appended hereto:

All . . . . . apparatus is fully guaranteed against defects of a mechanical or electrical nature or imperfections in workmanship *provided* the purchaser fills in the card attached and returns it to us for recording at the time sale is made, or the guarantee *does not* apply.

It is important to note herein that it is the responsibility of the *buyer* to protect himself.

A leading make of motor generator is sold under the following guarantee:

We guarantee that this motor generator will deliver successfully its rated output as indicated on the nameplate *provided* it is properly cared for and operated under normal conditions with *competent supervision.*

REPLACEMENT: We agree, and shall have the right, to correct by repair or replacement at our own expense and option, f.o.b. our works, any defects in the motor generator which may develop under normal and proper use within 12 months after *date of shipment,* when inspection proves the claim, provided the purchaser gives us immediate written notice of such defects and provided further that during this period the motor generator is properly cared for, operated under normal conditions and with competent supervision.

The correction of such defects by repair or replacement by us shall constitute a fulfillment of all our obligations to the purchaser.

When the motor generator is purchased and resold, the maximum guarantee

(Continued on page 25)

NEWSREEL SOUND QUALITY IS GREATLY IMPROVED

By J. A. BATTLE

STAFF, ELECTRICAL RESEARCH PRODUCTS, INC.

A theatre survey revealed that projectionists reduced the fader setting for newsreels from one to five steps, or three to fifteen db., below the nominal fader settings for feature pictures to obtain the same volume level. By adherence to accepted recording practices in the studio, newsreels are now being reproduced at the same fader settings as feature pictures, with a considerable improvement in sound quality, according to the appended paper, first presented before the S.M.P.E. A brief outline is given of the preparation of the newsreel from news camera to theatre.

THE newsreel sound quality, it was generally recognized, was not keeping pace with the improvements in feature picture sound quality, and the increasingly greater contrast became so apparent that it was evident that some measures should be taken to eliminate this contrast. The recordists were cognizant of the reasons for the lack of a commensurate improvement, but as long as one newsreel had to be as loud as or louder than its competitor it was futile to expect any marked improvement.

The coordinated policy of recording at reduced levels adopted among the newsreel producers, which became effective with the release of March 4, resulted in a considerable improvement in sound quality.

It was the original practice to reproduce newsreels at slightly higher levels than feature pictures, the theory being that the interest of the audience should be aroused and that the louder volume would enhance the value of the news. The reason for that seemed to be that the newsreel was apparently a lineal descendant of the town crier whose stentorian voice informed the vicinity at large of the news of the day.

At first the louder newsreel volume was accomplished by adjusting the theatre fader settings in accordance with a cue sheet, but later the increase in sound level was accomplished upon the film itself. Gradually this slight difference was increased to such an extent that the volume level of newsreels sometimes became actually uncomfortable; so much so, that projectionists began to acquire the habit of automatically "pulling down" the fader from one to five steps, or three to fifteen db., when showing newsreels.

To present to the producers convincing evidence that the method adopted to achieve loudness was defeating its own purpose, a survey of 150 theatres was made, unknown to the projectionists, by service engineers on their regular visits over a period of two or three weeks. Observations were made of the average fader settings of the feature picture and of the newsreel upon the same program, and the interesting figures shown in Table I, were obtained.

It was evident that the higher recording level was being offset by the lower fader settings. In order to obtain increased volume level, the recording equipment was operated beyond its optimal limits, contrary to the better judgment of the recordists, and light prints were released. The obvious solution to improve the quality was to adhere to accepted standards in recording and processing, or, in other words, to strive for feature production quality and return the control of the auditorium volume level to the proper place, i. e., to the projection room fader.

TABLE I

Change from Average Feature Fader Setting for Newsreel Projection	Average of 5 Newsreel Companies (Per Cent)
No change	6
Down 1 step (3 db.)	21
" 2 " (6 ")	25
" 3 " (9 ")	30
" 4 " (12 ")	14
" 5 " (15 ")	4
	100

The results of the survey were presented to the producers, who recognized the advisability of correcting the condition. The current release of each of the five newsreels was compared with a feature and a travelogue. and the comparative volume levels were measured with a volume indicator. The level of the newsreels ranged from +2 db. to +7 db., with reference to the level of the travelogue, which was arbitrarily selected as zero reference. The volume level of the feature measured —4 db. The zero reference level of the travel-

(Continued on page 23)

Super-Speed Camera Takes 1200 Full Frames Per Second

By HORATIO W. LAMSON
RESEARCH ENGINEER, GENERAL RADIO COMPANY

Just try to image 1200 full frames a second! The wink of an eye, the golf stroke, the splash of a drop of water, a falling object—all these are possible of analysis by this marvelous new super-speed camera about which projectionists certainly should know.

SLOW-MOTION movies of some famous pole valuter floating leisurely and gracefully over a slender bar high above the ground, or of the 2-to-1 favorite horse crawling with tantalizing lassitude down the home stretch are always interesting to theatre audiences who are mystified by the trick photography employed in producing such results.

The method of obtaining these intriguing pictures, which is, of course, familiar to all cinematographers, consists merely of running the ordinary motion picture camera at higher than normal speeds. Such a technique requires, naturally, either a more intense illumination of the object or the use of a faster lens than is necessary for normal speed operation. If the 200 frames which may be taken during an interval of one second by means of a superspeed intermittent-action camera, designed by A. S. Howell[1], are subsequently projected at a rate of say, 16 frames per second, an event which occurred in one second will, of course, take 12½ seconds to show on the screen so that the observed speed of motion will then be slowed down 12½:1.

When one attempts to increase this reduction ratio by a more rapid driving of an intermittent-motion picture camera, three serious obstacles arise.

First, the very rapid starting and stopping of the film as the frames are advanced, one at a time, between successive exposures, places tremendous accelerations and consequent strains upon the film which becomes in great danger of tearing or of igniting by friction. Secondly, as the operating speed of the oscillating members of the intermittent mechanism is increased, it becomes more difficult to make them engage and otherwise function with the necessary precision to insure very accurate framing.

In the third place, increased operating speed means, of course, reduced exposure time, which reaches its final practical limitations in the speed of available lenses, the permissible grain coarseness of high-speed emulsions, and the available lighting facilities.

Constant Film Advance

The first and second of these difficulties have, to a certain extent, been overcome in various forms of high-speed movie cameras in which the film no longer advances intermittently a frame at a time, but travels at a constant, high rate of speed. Furthermore, the design of these cameras is such that all oscillatory motions are eliminated and only simple rotary motion, at constant speed, remains. Successive pictures are obtained by systems of rotary lens or prism members. Thereafter the question of obtaining sufficient exposure becomes the deciding factor in limiting the speed obtainable. Noteworthy examples of this technique are to be found in the Jenkins camera[2] and a camera recently developed by Bell Telephone Laboratories.

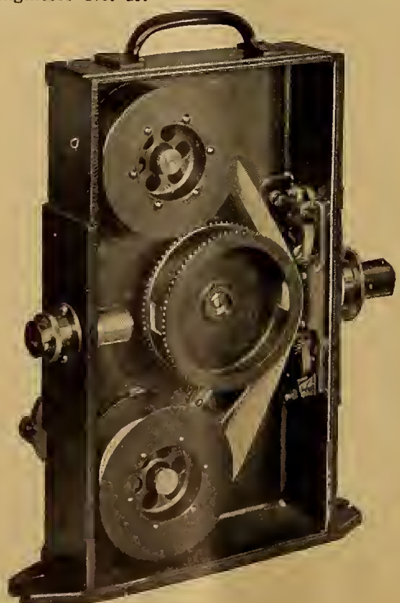

FIGURE 1

This problem of superspeed motion pictures has been undertaken in a radically different manner by Professor Harold Edgerton and his associates at Massachusetts Institute of Technology. The fundamental principle of their procedure was similar to that employed by Abraham and Bloch[3]. In collaboration with the author's company, a form of camera has been developed through which it is possible to run ordinary 35-millimeter perforated film at essentially constant speeds as high as 75 feet per second, approaching a mile a minute, and to take superspeed movies at the rate of 1200 full frames per second. This General Radio camera uses a single photographic lens of standard make with speeds varying between f/1.5 and f/2.5. The camera has no shutter and contains no moving parts except the film driving sprocket, and the magazine and take-up reels.

The question naturally arises in the mind of the reader: "How can a series of pictures be taken with such a camera?" The answer is that the shutter, or equivalent optical mechanism heretofore used with a *continuously illuminated object*, is replaced by a special form of flashing light known as a stroboscope. While ordinary daylight illumination of the object cannot leave any photographic impression upon the film moving at such high speed back of the wide open lens, each flash of the stroboscopic light makes one normal exposure or frame on the film.

The form of stroboscope lamp employed for this purpose and capable of producing the desired results is a special type of mercury-vapor electric arc, likewise first developed by Professor Edgerton and commercialized by the General Radio Company. This new arc possesses three important attributes.

Five Microseconds Exposure

In the first place, the duration of each flash, that is, the *actual exposure time*, is only five microseconds (0.000005 second). The conception of such a short interval of time is difficult for one unaccustomed to think of such magnitudes, but it may, perhaps, help to recall that an automobile racing down the highway at 50 miles per hour can only advance

[1] "Evolution of the Professional Camera," by Joseph A. DuBray, Cinematographic Annual, 1930.

[2] "The Jenkins Chronoteine Camera for High Speed Motion Studies," by C. Francis Jenkins, Transactions of the Society of Motion Picture Engineers No. 25.

[3] "Ultra Rapid Kinematograph," by H. Abraham and L. Bloch, Comptes Rendus, December 1, 1919, No. 169.

a distance of 1/200th of an inch or less, the thickness of a piece of paper, during this exposure time. Thus, although the object photographed may be moving at a high rate of speed, and although the film itself is traveling rapidly all the while, the time of exposure is so short that neither object nor film can move an appreciable distance during the exposure. As a result, good definition of high-speed objects can be obtained since, at maximum camera speed, the film moves only 0.004 inch during the full time of each exposure.

In the second place, during this extremely short exposure time, the intensity of the illumination is very great, for a perfectly normal exposure may be made *by a single flash* using an f/2.5 lens with ordinary panchromatic film. All our readers know by experience how well an object must be illuminated to secure a normal exposure with an f/2.5 lens and a fast 0.005 second shutter. They can, perhaps, realize how intense an illumination must be required to secure the *same exposure* in 0.000005 second, the equivalent of a shutter speed 10,000 times as fast.

Finally, the exact instant at which each flash occurs can be determined very accurately by means of a commutator mounted directly on the shaft carrying the film sprocket so that, whatever the actual camera speed, the successive exposures on the film will be framed for subsequent projection, accurately and automatically. It is indeed hard to imagine any type of mechanical shutter capable of giving a normal exposure in 0.000005 second with a constantly illuminated object and, at the same time, being capable of repeating such a procedure 1200 or more times per second.

The Camera Mechanism

Figure 1 shows a form of camera designed to take short runs of superspeed pictures. The upper magazine reel holds 100 feet of 35-millimeter negative which is fed down over a portion of the circumference of a 5-inch diameter driving sprocket and thence onto the take-up reel below. The exposure is made while the film is moving on the driving sprocket and forced to lie flat against the rim of the sprocket by upper and lower guide rollers.

The optical system of the camera is such that the slight curvature of the sprocket over the ¾-inch length of each frame does not appreciably disturb the focus. By observing the back side of the film through two holes in the driving sprocket by means of a telescope in the rear of the camera, one may focus the adjustable lens mounting and align the camera on the region to be photographed.

While the mechanism of this camera is quite simple compared with that of the standard intermittent-action machine, all parts must be made and fitted with considerable accuracy so that they shall function smoothly at the high speeds employed. A single slide gives access to the whole interior of the camera and, by employing black paper leaders for the film on the special light-tight magazine and take-up reels, loading and unloading may be accomplished in the daylight.

Figure 2 shows that two independent electric motors are used to drive this superspeed camera. One of these motors mounted on the body of the camera, is connected directly to the shaft of the take-up reel. The other motor, mounted on the camera base, drives the shaft carrying both the external framing commutator and the internal film sprocket by means of a belt. The use of these two motors and the proper design of the film path with the absence of any loops or film slack are vital to secure the quick initial acceleration and uniform travel at high film speeds obtained in this camera.

The entire film magazine must be emptied with each shot, since it is impracticable to attempt to stop the film in transit at such speeds. The actual speed of the camera may be controlled by adjusting the voltages on the driving motors. At speeds *below* 500 *frames per second* the film may be stopped in transit, if desired.

FIGURE 2

Portable, table-type power unit for two large mercury arc stroboscope lamps

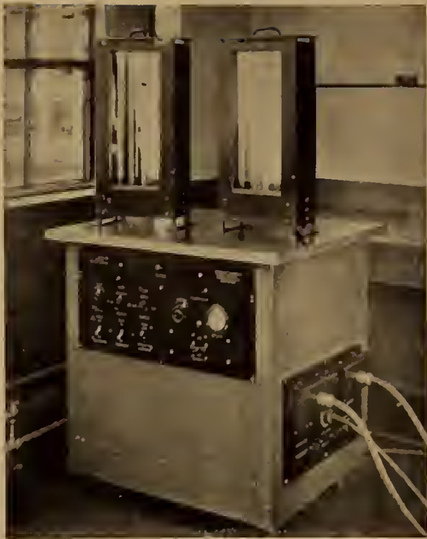

FIGURE 3

Figure 3 shows the portable, table-type electrical power unit, which is energized from 60-cycle power mains, together with two large mercury-arc stroboscope lamps used for obtaining pictures at the rate of 1200 per second. A much smaller model of the same type of stroboscope, which is designed primarily for visual stroboscopic work, may, nevertheless, be used to take high-speed movies up to the comparatively "slow" speed of about 120 frames per second.

Motion Slowed to 75:1

When superspeed movies taken at the rate of 1200 frames per second are subsequently projected 16 frames per second, the apparent speed of motion is slowed down to 75:1 and *an event actually occurring in one second takes one and one-quarter minutes in showing.* It should be borne in mind that these results are reflected light photographs and not merely the silhouettes obtained in most of the earlier forms of high-speed movies.

Equipment of this kind is extremely valuable in scientific and engineering studies of the motion and vibrations of high-speed machinery such as is found in the automotive, aeronautical, electrical, textile, woodworking and other industries.

From the point of view of a movie camera, the necessary stroboscopic light source limits the field of action to close-ups of a somewhat limited area. Nevertheless, many surprising shots of general interest have been made at these superspeeds, such as the kicking of a football, the stroke of a golf drive, the fall of an animal, the flight of birds and insects, the rapid movements of a snake's tongue, the interesting motions in a jet of water, the beautiful phenomena exhibited by a spatter of liquid drops in a pool or against a smooth, hard surface, the shattering of objects. the impact of bullets, the wink of the eye and other physical motions and so forth.

In addition to the regular practice of taking 1200 full ¾-inch frames per sec-

(*Continued on foot of next page*)

UNIFORM PRINT DENSITY IS PROMISED SOON

Varying print density, long a prime topic for projectionist objections, bids fair to be a memory soon, according to a report issued recently by the Academy of M. P. Arts & Sciences subcommittee which has just concluded an exhaustive survey of laboratory conditions.

The report announced the future establishment of a set of standard density tablets to which instruments in all laboratories will be calibrated. A set of standard tablets made of a thin coating of platinum sputtered on a glass base are now being prepared by the Mount Wilson Observatory and the California Institute of Technology. These tablets will permit, for the first time, any laboratory to directly compare readings of its own instruments with readings of instruments in any other laboratory, and will help greatly to establish closer technical coordination between negative and release print laboratories.

The problem of release printing has always been complicated by the fact that negatives are usually made in one laboratory and prints in another (in the East or in foreign countries) thus making it difficult to transmit adequate instructions and control specifications.

In the method under consideration release printing data will be placed on the negative in a space provided in the S. R. P. where it will be available for the information of any laboratory in the world.

Further interesting data anent print density, of particular interest to projectionists, is contained in the appended discussion at a recent S. M. P. E. technical session:

Dr. Goldsmith: If reels are printed to different densities and if the corresponding loudness of reproduction is different, that would not be so serious as it is at present if only the monitoring system in the theatres were simple, instantly available, and effective. In other words, if a skilled person were sitting in the body of the house with a volume control under his fingers, and the instant the first spoken syllable or the first musical note were heard to be too loud, he could turn the control back to the necessary extent, or turn it up if it were too soft, that would not be so serious.

If we are going to have unequal densities and unequal loudness on changing from one system of recording to another, it is necessary to have instantaneous and effective monitoring in the body of the house. If we are not going to have printing errors rectified, then we must have that type of monitoring.

Mr. Shea: I understand that the Sound Committee at one time considered monitoring methods of that kind and ran into difficulties. They found it very difficult to recommend a satisfactory monitoring method.

Dr. Goldsmith: With automatic or manual control?

Mr. Shea: Either automatic or manual.

Radio Broadcast Comparison

Dr. Goldsmith: The control-room operator in a broadcasting station is able to monitor a broadcasting program and keep it within proper limits without the least difficulty; and I do not understand why a good broadcasting control-room operator seated in the body of the house with a volume control in front of him and a trained pair of ears on him cannot correctly monitor a program.

Mr. Tanney: Some years ago the squeeze-track was used. Wasn't that an attempt to modulate the sound to a constant level?

Mr. Shea: The squeeze-track method related to the studio. It was to be used either in recording or in editing. The difficulties mentioned here have relation to the laboratory that makes the release prints or the projection difficulties encountered in the theatres. There is a somewhat similar condition in radio, in that the broadcasting studios are about as particular as the motion picture studios, because their work is done only once; but the work of each individual theatre, like the adjustment of a radio receiver, affects only one group of listeners.

Industrial Diseases Have Insidious Growth

Many industrial diseases are slow in developing and difficult to recognize in their early stages. Not until considerable time has elapsed after exposure—in some cases only after several years—do the more serious effects of some diseases appear.

Signs and symptoms of these diseases are not evident early enough to warn the worker, and often he may absorb what may prove to be a dangerous amount of poison before he even realizes that he is ill.

There is a difference in susceptibility among the individuals exposed to the same amount of poison. There are also wide ranges of susceptibility varying with race, age, and sex. Young workers, both girls and boys, have proven more susceptible than older workers to certain diseases, such as lead poisoning (frequently encountered among projectionists) and tuberculosis. Women workers suffer from certain poisons far more seriously than do men.

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ond, it is possible, by reducing the effective frame length on the negative and driving the sprocket at somewhat greater speeds, to attain three or four times this pictorial speed under certain conditions. Such "compressed" negatives must, of course, be separated to ¾ of an inch frame spacing when printing the positive film for projection.

There is an old saying that the hand is quicker than the eye. While this may be true for the unaided, credulous eye of the victim of the old-time shell game, nevertheless the eye, aided by the super-speed movie camera, can convert the sudden motions of a magician or the fastest efforts of a great athlete into something far slower than the hesitant plodding of a reluctant schoolboy past the old swimming hole on a June day.

Good Projection a Vital Industry Necessity, Says Cecil B. De Mille

PROJECTION is the neck of the bottle through which flows the sum total of all production efforts, said Cecil B. De Mille, noted producer-director in a recent press interview in New York. News reporters who gathered to interview De Mille expected him to discuss production problems in general or the merits of his latest opus, "The Crusades," the world premiere of which had brought him to New York.

Upsetting the dope, however, De Mille floored his repretorial audience by plunging into a discussion of the importance of projection and sprinkling his monologue (it was nothing else) with caustic references to petty economies which result in poor reproduction.

"Producers strive and strive, sometimes over a period of months, to make a given production letter-perfect from the studio angle, only to have their efforts fail because of inferior projection," said De Mille. "I often wonder why we make pictures at all, if the projection process is to render useless our best efforts.

"Why, more than 50 per cent of the theatres in America are delivering inferior projection results, and this being so, how in the world are we ever going to properly merchandise our product?"

De Mille criticized severely the uneven quality of sound in theatres, pointing out that in other industries manufacturers give their products the same presentation in small towns as they do in New York. When in New York, De Mille never fails to spend some time with Harry Rubin, director of projection for Paramount, and he insists upon Rubin handling all first showings of his big special productions.

Academy Double-Reel Proposal Discloses Several Basic Defects

By JAMES J. FINN

SHARP division of opinion exists among the craft as to the feasibility and desirability of the new double-reel standard proposed by the Academy of M. P. Arts & Sciences, according to scores of opinions filed with I. P. As was anticipated, the purely technical aspects of the proposal were given scant attention by the aforementioned correspondents, the bulk of the objections being based on a rather hazy conception by the craft of its "rights."

Craft opinion on double reels, as revealed in letters to I. P., encompasses every conceivable objection that might be mustered. Charges that the double-reel standard is a deliberate attempt to effect widespread reductions in manpower were numerous, and not a few such comments originated in localities where one-man shifts have held sway for years.

One correspondent viewed double reels as an unwarranted imposition on the older men in the craft, the larger reel being "too heavy to lift." Such men, continued the correspondent, "will not thank I. P. for its share in bringing about a 2000-foot reel standard." Anyhow, he continues, 1500 feet would be the ideal size.

Cite Greater Fire Hazard

Many commentators became positively lyrical anent the greatly increased fire hazard which double reels will introduce. This topic induced word pictures of the dangers of fire, the result of using larger film lengths, worthy of publication in columns vastly more literary than I. P. Other objections related to the desirability of a 14½-inch reel instead of the proposed 15½-inch size, and also favored a 4½-inch hub instead of one of 5½ inches. These objections have been discussed in detail previously in these columns.

Meanwhile the Academy pressed for adoption of the proposed standard. Studio heads were acquainted with details of the new reel size and asked to register approval thereof. Laboratory and exchange men received detailed instructions as to future procedure Opinions as to the technical worth of the reel were solicited from leading projection men. Manufacturers were asked to submit bids on large quantities of reels. Every major company was represented at a meeting of managers of exchange operations held in the New York headquarters of the Hays organization.

I. P.'s own investigation into the technical merits of the proposal gave rise to several suggestions for improvement of the detailed standards as published herein last month. First, it should be noted that I. P. has never recognized any connection between reel length and manpower—not at this late date, at least —and it considers the alleged greater fire hazard to be purely imaginative on the part of the craft.

On the editorial end the Academy specifications provide for a "direct cut" after the first 1000 feet of film. The phrase "direct cut" is rather indefinite and allows the cutter a bit too much latitude. Obviously, the ideal cutting spot would be on a fadeout; but in no event should a cut be made within 2 or preferably 3, feet of significant action or sound. Emphasis on this point is important, since the reels will be cut and subsequently shipped to exchanges in 1000-foot lengths, with the exchange having to join two lengths of approximately 1000 feet into a double reel of film.

1750-Feet Length Best

Academy specifications provide that "in no event should the total length of any reel by less than 1700 feet." This provision is not as air-tight as the recommendation of the Projection Practice Committee of the S. M. P. E. that the absolute minimum length of any reel should be 1750 feet. Some de-luxe theatres have extra large magazines accommodating 3400 feet of film. An Academy "standard" reel of 1700 feet, therefore, could be doubled and handled by such theatres. Then again, cutting and exchange losses might easily reduce the single reels to less than 1700 feet.

This is not a captious criticism of the Academy proposal, because experience has demonstrated that there is no limit to the ingenuity displayed by some projectionists in joining film reels.

In localities where the use of double reels is prohibited by either Union or local laws (and there are such, despite Academy assurance to the contrary) a real problem will arise. Film will come from the laboratory in 1000-foot lengths and without any S. R. P. change-over marks or any run-down or run-out film. The question arises: is the exchange to be depended upon to affix proper markings and attach the extra film required? If so, then one can easily visualize the approximate quality of the prints, the exchanges having compiled a notable record of inefficiency in this respect.

There are any number of cities and towns where such restrictive laws are in force, including Boston and Chicago, comprising at least one-fifth of the total national distribution. The Academy has not indicated how it will crack this tough nut.

The avowed primary reason for the introduction of the longer reel is a reduction of film mutilation through elimination of "doubling," the practice wherein projectionists now join reels together through the medium of splicing. Still, the Academy states that the cost of new reels, of which there will be only one-half as many as the old single reels because of the double capacity, will not exceed twice the present cost of single reels.

Quality Reels, Cans Needed

Theoretically, this is so. But if the Academy is figuring costs on the basis of present quality of both reels and shipping cases, then the film mutilation evil, instead of being eliminated, will be more pronounced than ever. Present reels are of such poor quality that they are wholly unsatisfactory for shipping, much less for projection. INTERNATIONAL PROJECTIONIST is reliably informed that quotations of less than 50 cents per double reel have been received favorably by the West Coast. It is difficult to understand how reels at this figure, even in quantity lots, could prove satisfactory.

Managers of exchange operations for major companies, meeting in New York, seemed committed to individual purchasing of reels, as opposed to cooperative buys through any one source.

Present reels and shipping cans are responsible for a large percentage of

Trouble Ahead For Double Reel

An indication of trouble ahead for the sponsors of the 2000-foot reel standard came from Boston, one of the cities having single-reel legislation, when Local 182 reiterated its unrelenting opposition to the use of double reel lengths of film. The Union has no intention of reconsidering its recent approval of a law providing for a $50 fine for any member using double reel film lengths.

current film mutilation. If this equipment were of good quality, and no film mutilation resulted therefrom, the Academy theory of twice the weight and twice the cost for the new double reels probably would work out. As matters now stand, however, the Academy theory seems to lead up a blind alley.

Prominent projection men, such as Harry Rubin, director of projection foi Paramount, are strongly in favor of a preliminary experimental period during which the regular routine to be followed after January 1 next would be put into effect in the interim covering a limited number of theatres. In this way, it is held, the Academy could obtain more data on practical aspects of the situation —including laboratory and exchange routine, plus the worth of reels and shipping cans—than it could through a year of discussions by engineers, a majority of whom know little or nothing about the exchange or projection processes.

Concern has been expressed as to the handling of newsreels and short subjects which necessarily will come to the theatre in sub-standard lengths. This situation offers no difficulty, since even if shorts were tacked onto the last reel of a feature, there is provided ample footage at the beginning and end of every feature to remove any fear of mutilation or serious loss of film.

Mutilation has resulted from the practice of in-between-reel doubling, rather than through the joining of two unrelated subjects.

Reader Service Department

P. E. Cell Testing

Kindly advise what is the best method of testing the RCA 868 photo-electric cell. How can one know when it should be replaced. Also, please advise a simple method of matching cells. We are using same on RCA Type PG 10 equipment.

Hawaii Film Supply Co.
Honolulu, Hawaii

The RCA 868 photo-electric cell is best tested with a microammeter in series with a 90-volt battery supply. With the exciter lamp on and properly focused, read the current in direct scale on the microammeter. A more simple method is the flicker test: with the exciter lamp on, interrup the light beam by flickering a strip of carboard, etc., at the sound gate.

A photo-electric cell should be replaced when it is noisy or when its output has been so reduced that it cannot be properly matched with a normal photo-electric cell.

A simple method of matching photoelectric cells is by means of the flicker test.

From Springfield, Mass., comes this query by a projectionist who apparently was confronted with a mystery as baffling as those that he projects in cinematic form upon the screen:

"We have recently played four M-G-M pictures—*West Point of the Air, Times Square Lady, Reckless,* and *Casino Murder Case.* Each of these pictures had a close-up of a girl's head in the five frames immediately preceding the eleven-foot frame. The close-up was the same with each feature and appeared in the leader to each reel.

"We have had many discussions relative to just what this head signifies, if anything, and we decided to leave it up to you to supply the correct explanation."

H. B. Smith

This incident is a reflection of the M-G-M economy campaign. Instead of using blank leader, as is usually done, screen test film is used. Since most testing is done in New York and Los Angeles, exchanges closest to these points have much more of this screen test leader than the mid-Western branches.

It's Not the Heat—It's the Humidity

At this time of year many letters are received recounting difficulties—high power factor, low leakage resistance—which are directly due to the prevailing high humidity, reports the General Radio Co. Since it's the weather, not much can be done about it, unfortunately.

Even though direct absorption of moisture is negligible, the formation of a film on the surface lowers the insulation resistance and, when subjected to alternating potentials, introduces a material loss. Among insulators there are great differences in moisture effect due to surface characteristics. Roughness or pores at molecular dimensions are the important factors. Such ceramics as isolantite are coated to reduce absorption.

Even Best Materials React

An insulating material which water does not wet is usually only slightly affected by surface moisture because the water collects in discrete drops and does not cover the whole surface. Yellow bakelite, XN-262 Natural, used in many places where high insulation resistance and low dielectric loss are desired, owes its remarkable freedom from the effects of surface moisture to this property.

Unfortunately, some of the best dry materials show the worst absorption characteristics. Mica and quartz, both crystalline and fused, show larger decreases in their insulation resistance with moisture than many other insulators having much lower volume resistivities. This characteristic serves to decrease the difference between these insulators and others of lower volume resistivity as the humidity of the surrounding air is increased. In fact, it is quite possible, under the effects of high humidity, for quartz insulation to have a lower resistance and larger power factor than many ordinary ceramics.

No Specific Remedy

There appears to be no specific remedy for this effect of humidity on insulation except local heating or air conditioning. The extent to which such a conducting film forms is dependent both upon the temperature of the insulator with respect to the ambient temperature and upon the characteristics of the surface itself.

An insulator which is maintained only a few degrees above room temperature will be very little affected by even a high degree of relative humidity. On the other hand, large amounts of moisture will collect upon insulators which are a few degrees lower than the surrounding temperature.

RCA To Market Trans-Lux Rear Projection Unit

RCA has completed arrangements with the Trans-Lux Movies Corp. whereby the company's Photophone Division will handle the leasing of Trans-Lux rear projection equipment, either in conjunction with its own "High Fidelity" sound reproducing system or with competitive sound apparatus.

The Trans-Lux equipment, hereafter to be termed RCA Trans-Lux consists of special wide-angle lenses for adapting standard motion picture projectors to rear-screen projection, and a patented transluscent screen upon which the motion picture image is focussed from behind the screen. The principal advantages of the Trans-Lux system are its economical adaptation to the small, intimate type of theatre which need have no expensive balconies or high ceiling clearance; since the light source is in the rear of the screen, eyestrain caused by looking through the glare of the light rays in a darkened theatre is minimized; and distortion from the angle and distance of the throw from the balcony to the screen is eliminated.

Permits Auditorium Lighting

With the Trans-Lux system the house may be kept partially lighted without impairing visibility, and there is no appreciable distortion of the images on the screen from the side or up front seats. The first Trans-Lux installation was made in March, 1931. in New York, and it has been successfully followed by other installations in three other N. Y. City locations, and in Philadelphia, Minneapolis and Milwaukee.

Kodachrome Process for Natural Color Cinematography

By L. D. MANNES *and* L. GODOWSKY, JR.
COMMUNICATION NO. 549 FROM THE KODAK RESEARCH LABORATORIES

What is Kodachrome? Displacing rumor and mis-statement is the accompanying authoritative presentation of data anent this most recent color development. The article contains in addition to the Kodachrome data, much interesting general color information.

THE Kodachrome reversal process recently introduced is the result of an attempt to produce a color process that would involve no problems not incidental to black-and-white photography. While this was by no means achieved in its entirety, the process is, at least from the photographers' and projectionists' point of view, as simple as black-and-white photography. The problems involved are confined to the manufacturing and processing of film, thus placing the burden upon highly organized production facilities rather than upon the sometimes unskilled consumer.

Pictures taken by this process are exposed at virtually normal speed in an ordinary 16-mm. camera of any type having a capacity of 100 feet and projected with any 16-mm. projector. No filters are usually necessary in taking or projecting, save in the case of artificial light, where a blue compensating filter is used over the camera lens. Under special daylight conditions involving haze, cold light, or an abundance of reflected ultra-violet light, it is sometimes desirable to expose through a colorless filter which absorbs most of the ultraviolet but does not change the color balance or exposure conditions.

Classification of Kodachrome

Color processes are generally divided into two types, the *additive* and *subtractive*. With the additive process the actual, red, green, and blue colors are either visible in the film itself or are formed by an optical system, as with Kodacolor. These primary colors are projected onto the screen for viewing. Additive methods include Kodacolor, color-screen plates (such as the Autochrome plate), Dufay-Color, and others.

Any possible color upon the screen can be formed by additive combinations of the primary colors, red, green, and blue. Likewise, they can be formed by proper subtractive combinations of the complementary colors. The complement of red is blue-green, of green is magenta, and of blue is yellow. These complements are sometimes referred to as the *minus* colors, thus:

Primary Color	*Complementary Color*	
Red	Blue-green	(Minus red)
Green	Magenta	(Minus green)
Blue	Yellow	(Minus blue)

Subtractive processes, of which Kodachrome and Technicolor are examples, form their colors by combining the three complementary or minus colors. The minus or subtractive colors merely absorb the corresponding primary color from the projection beam of light. Such a light-beam may be considered as white light or as containing a combination of all colors.

If we put a blue-green (which is to say, *minus red*) filter or dye deposit into such a white light-beam, the red will be absorbed and the screen will appear blue-green. If, however, we add a magenta (*minus green*) filter to the blue-green filter mentioned above, both the red and the green light will be subtracted from the white light-beam. The only light left to go on through to the screen is blue, and that will be the color of the screen. Similarly, any color may be formed.

Accordingly, the blue-sensitive layer of Kodachrome will in the finished positive contain the complement of blue, which is yellow; the second or green-sensitive layer, the complement of green, namely, magenta; and the bottom or red-sensitive portion will contain the complementary color of red, which is blue-green.

New Weston selective analyzer, having a wide range selection, which meets sound system servicing requirements

The Kodachrome Film

Kodachrome film is panchromatic and bears the ordinary jet backings as used on regular Cine-Kodak film. The emulsion, however, consists of three layers, each sensitized to one of the primary colors and separated from the adjacent layer by a thin coating of clear gelatin. The top layer of emulsion, upon which the light first falls in exposure, is sensitive *only* to blue light, but it does transmit green and red light to the layers *underneath*. While it is sensitive to the blue, it also contains a yellow dye which *prevents* the blue light from passing through to the silver bromide grains below.

The second, or middle, layer is sensitive to green and blue light, but as all blue is filtered out by the yellow dye just mentioned, we need to consider only its reaction to the green.

Next to the film support is the bottom, or third, emulsion, which is sensitive to red and blue; but here again, the blue being stopped in the surface layer, this emulsion reacts to red *only*.

Briefly, there are three separate emulsions sensitized as follows: the first or top layer to blue, second to green, and the third, or bottom, to red light. Each coating is exceedingly thin so that the total thickness is about the same as the thickness of black-and-white coatings.

Kodachrome film is exposed in the normal manner, that is, with the emulsion side toward the lens. It is unnecessary for the light to pass through the support, as it does in Kodacolor or any of the color-screen processes. The speed of the film is somewhat less than that of regular panchromatic Cine-Kodak films.

Processing Kodachrome Film

Processing is carried out in continuous machines by a reversal process which converts, by the usual method, the images in all three layers to their corresponding positives. These three positive images are then differentially dyed the three corresponding or minus colors previously described, i. e., blue-green, magenta, and yellow. All silver is then removed from the film, after which it is washed and dried. The final positive

A definite fire hazard. Notice the deep undercutting of this sprocket which, believe it or not, is in far better condition than thousands of others now doing daily service

accordingly carries a dye image only.

From the three stages of processing described, we now have the three complementary colors in their respective layers. The amount of each will depend of course, upon the amount of silver bromide removed in bleaching the original negative. The three colors in turn will combine to form the positive image in natural color.

As the finished Kodachrome film contains the actual colored image, projection is carried out under normal conditions. No filter is used. The light-source, projection distance, and type of screen are the same as for black-and-white film.

Discussion:

Mr. Kellogg: Will Kodachrome be available in roll film for ordinary cameras?

Mr. Crabtree: I do not know; it is not available at the present time.

Mr. Dubray: What would be the effect of under- or over-exposure?

Mr. Crabtree: The effect is relatively the same as with black-and-white 16-mm. film.

Mr. Hopper: How permanent are the colors? Is the dye fairly permanent after projection?

Mr. Crabtree: I see no reason why they should not be satisfactorily permanent. Any dye, of course, is apt to fade under certain adverse conditions.

Miss Evans: How soon will you be able to develop prints on the Pacific Coast without sending the films back to Rochester?

Mr. Huse: It is contemplated that by late fall we shall have equipmment available in Hollywood for processing Kodachrome film, just as we have for black-and-white films. Arrangements are being made at the present moment to that end.

35-*mm. Film Situation*

Some persons may have been wondering what is going to happen as regards the 35-mm. film. Up to the present time all our developmental work has had to do with the 16-mm. process. A great deal of work is still to be done in making duplicates or prints from that. Our experimental work on 35-mm. film has not really begun. We shall, no doubt, collaborate with Technicolor on that, for the reason that Dr. Troland's patent indicated that he had done work on a somewhat similar process. What will happen in the future we must wait to find out.

Mr. Timmer: Is it possible to put a sound-track satisfactorily on this film?

Dr. Sandvik: There is one problem that should be considered, and that is the problem of getting dyes that will, in addition into giving satisfactory visual color rendering, also have sufficient absorption in the spectral range to which the photoelectric cell is sensitive.

As most of you know, in the past two years the trend has been to extend the sensitivity of photoelectric cells farther and farther into the infrared, until now some of the cells have the maximum sensitivity at 0.9 mu, which is far beyond the red end of the spectrum. It is a question then of either choosing dyes having a fairly high absorption in the infrared or else sacrifice some of the photoelectric cell sensitivity by using dyes that have a lower absorption throughout the spectral region to which the photoelectric cell is sensitive.

Notes on New RCA High-Fidelity Recording

Generally speaking, the sound waves created either by vocal cords or musical instruments are directed to a microphone which transforms them to directly proportional electrical waves. These electrical waves are amplified and then passed through a galvanometer or light valve where they are transformed to directly proportional light waves. These light waves are focussed on a portion of the negative film and photographed thereon, the result being generally known as the "sound track."

The similarity between this process and that of reproducing sound from film can be easily seen. In reproducing, a constant light source is directed at the sound track on a positive film. The light emanating from the other side of the film consists of varying light waves directly proportional to those directed at the film in the recording process. These light waves pass through a photoelectric cell which transforms them into directly proportional electrical waves. They are then amplified to a useful intensity and passed through a loudspeaker device which transforms them to directly proportional sound waves.

These sound waves, if both systems are 100% efficient, are directly proportional to the sound waves directed at the microphone in the recording process.

Two Recording Methods

The balance of the recording equipment is, of course, of great importance. All apparatus must be highly efficient, simple in design, and easy to operate. Under no circumstances may any extraneous electrical currents be introduced, and the equipment must be as nearly 100% efficient as possible throughout.

Two types of microphones are employed for sound-on-film recording. The velocity microphone has already received great recognition in the broadcasting field. Its highly directional characteristics make it particularly useful for recording purposes. Varying climatic conditions have no affect upon it and it is uniformly directional for all frequencies from 40 to 10,000 cycles. Its pre-amplifier can be located at some distance away from it, which makes it easy to handle. A pressure-operated microphone, suitable particularly for outdoor recordings is also used.

The electrical waves from the microphones, after having been amplified by the pre-amplifier—of which there is one for each microphone—pass through a microphone distribution panel, speech compensator panel, and a mixer panel which permits the varying of the frequency characteristic and level of each microphone, where more than one is used. The sound then passes to the main amplifier. This is a high quality device with a uniform frequency characteristic from 30 to 10,000 cycles and with an amplification of 80 db.

The signal then passes to the galvanometer or the recorder. A portion of the signal is directed from the recording amplifier to the ground noise reduction amplifier where it is amplified and rectified for use with this system. Another small portion of the signal is also directed from the recording amplifier to a monitoring amplifier where it is amplified and passed through a monitoring loudspeaker which is located in the control room. Other control and power equipment, of course, is required for simple operation of the entire equipment.

RCA High Fidelity recording equipments are designed for operation with either 220-volt, 3-phase, A.C. synchronous or Selsyn motors.

The entire system is designed and can be so adjusted that the frequency characteristic of the recording permits an acoustic output on a High Fidelity reproducer flat from 40 to 10,000 cycles per second. This recording characteristic is often modified to obtain satisfactory results with an average reproducing equipment.

New G. T. E. Financial Is Greatly Simplified

General Theatres Equipment will have no funded debt, no preferred stock and no bank loans when it emerges from the reorganization now in progress. When it entered receivership the company had bank loans of $19,000,000. outstanding preferred stock of $47,000,-000, a funded debt of $30,000,000, and nearly $2,000,000 of common stock.

Capitalization will consist of only 450,000 shares of common and 150,000 stock purchase warrants operative at $10 a share, according to present indications. Creditors will probably be enabled to buy seven shares of Fox Film A stock at $15 and $17 for a two-year period.

S. M. P. E. Fall Convention at Wardman Park Hotel, Washington, D. C., October 20-24, inclusive.

News of the Month

Brief mention of men and events associated with the motion picture industry of particular interest to projectionists is published here.

N. Y. a Union Shambles

New York City is again a union shambles. Despite a record of the highest earnings from theatre operations in its history, Loew Theatres, Inc., headed a group of major circuit exhibitors which, ignoring the usual Union channels, served direct notice on individual members of Local 306 of a straight 41% wage cut. Coming only 10 days after the new Local 306 officers were inducted, the notice was accompanied by two slips, one an acceptance and the other a rejection of the cut, which required a positive answer.

Joining with Loew in this obvious attempt to shatter the morale of L. U. 306 were the RKO and the Skouras circuits, the latter the operators of the vast new National Theatres group, an outgrowth of the old Fox West Coast organization.

Having cast their chestnuts into the fire, the Big 3 then attempted to inveigle the Vaudeville Managers' Association of N. Y. into backing their arbitrary wage cut scheme, although the Association had not been consulted prior to the move. In this the Big 3 were handed their first rebuff through the refusal of Warners, United Artists, Paramount and the giant Music Hall refusing to go along with the plan.

In fact, the Rockefeller family, which controls the Music Hall, let it be known in no uncertain terms that not only would they remain aloof from any move against the I. A. unions but that they considered the plan basically unsound and sloppily executed. The Rockefeller interest further made some pointed comments anent the "chiseling" of the other circuits, and observed that the Music Hall was not in the category of any Loew or RKO "shooting gallery" on the East Side.

The Big 3 sustained still another shock when the U. S. Department of Labor intervened and sent conciliators into N. Y. to assist in a settlement. Negotiations are now in progress between Local 306 and the Big 3, the general opinion being that a cut of at least 15% will result, since N. Y. City has more than 5,600 licensed operators and only 1,800 projection jobs, and the Big 3 are well fortified with non-union men.

The answer of L. U. 306 to this intimidation was to stage an intensive and effective publicity campaign and to enlist the support of other N. Y. City unions. The L. U. 306 membership vested authority in its officers to strike. An association of unions was formed—including the Scenic Artists. Grand Opera Choral Alliance, Grand Opera Artists, Federation of Actors, the Musicians, Sign Writers, Stationery Engineers, the Theatrical Managers and Agents, and the stagehands—and notice was served on the Big 3 of cooperative action in the event L. U. 306 failed to settle.

Cross-Picketing Resumes

Meanwhile L. U. 306 opened up an intensive mass picketing campaign against all non-union theatres. Hundreds of L. U. 306 pickets have already been arrested, and several houses have been bombed. One of the other so-called unions, Allied, retaliated by picketing the Local 306 circuit houses. N. Y. City is again a maze of pickets, even though the present scale they all are fighting about *averages* only $30 weekly in the smaller houses.

The latest development concerns the possible merger of the two non-A. F. of L. unions, namely Allied and Empire. The latter was formed some years ago by the exhibitors during the Kaplan regime; but subsequently it got out of hand and during the Sherman tenure of office was ready to amalgamate with 306. The exhibitors rushed to court and pointed to a clause in the Empire contracts, running for ten years, which specifically prohibited merging with the A. F. of L. unit. Allied is the group, formed in 1933 just before NRA, which was designated by the N. Y. State Supreme Court as an out-and-out company union.

Now, however, it appears that the exhibitors will waive their contractual rights and permit the merger of Allied and Empire. Where this will leave L. U. 306 is a moot question.

Concerning the situation in its entirety, INTERNATIONAL PROJECTIONIST has only one comment to make editorially: this is the same identical situation, down to the last fine detail, that the distinguished Mr. Sol A. Rosenblatt was going to settle "shortly" from October, 1933, to June, 1935.

Film Executives' Pittances

By way of information, it develops that through the recent merger of Fox Film and 20th Century Pictures, Mr. Sidney Kent, president of the combine, will receive $2,500 weekly, and on Dec. 31 of each year $50,000 additional, plus $75,000 to be paid him on Nov. 1 next, plus $200 weekly for entertainment, plus $25,000 a year from National Theatres Corp., a Fox subsidiary, plus an option annually on 10,000 shares of the new common stock until a total of 60,000 shares is reached.

Mr. Darryl F. Zanuck, infant prodigy of production for the new combine, will have to struggle along on a paltry $5,000 weekly, plus a month's vacation annually with pay.

Color Film Prospects

Though of the opinion that color and three-dimensional films are the next forward steps, Edward Small, Reliance Pictures head, opines that the public is not yet ready for color and that it will take a $25,000,000 educational campaign to smooth the way.

I. A. Extended Jurisdiction

Appearing before the recent meeting of the A. F. of L. Executive Council in Atlantic City, President George E. Browne of the I. A. asked for jurisdiction over all theatrical workers, including ushers, ticket takers, cleaners, cashiers, etc. If success attends this plea, I. A. membership would mount to around 60,000.

New Dallas Examining Board

Dallas, Tex., now has a projectionist examining board consisting of two projectionists, two managers, two exchange managers, the building inspector, fire marshal and the city electrician. The Dallas unit of the I. A., charging incompetency, proposes that a new board to be created consist of two projectionists, the fire marshal, city electrician. and the supervisor of public works, the latter to be permanent chairman.

Ashcraft Plant to East

The plant of the C. S. Ashcraft Mfg. Co., makers of projection arc lamps, formerly located in Los Angeles, has been transferred to 47-31 35th St., Long Island City, N. Y.

St. Louis Difficulties

In the exercise of active supervision over L. U. 143 of St. Louis, which it assumed recently, the I. A. has temporarily suspended all Local officials pending an investigation of the Local's affairs and an audit of its books.

Meanwhile the Local was engaged in a stiff tussle with the Urban League. Negro Uplift society, which threatened boycott of three theatres unless projection rooms were manned by Negro projectionists. An arbitration board ap-

Notice!

Subscribers are urgently requested to promptly notify I. P. of any contemplated change of address, but in any event not later than two weeks in advance. Notices returned to the publisher by the Post Office are not only expensive but very often fail to give the subscriber's correct new address.

The cooperation of I. P. readers is earnestly solicited so there may be no interruption in the continuity of mailing.

pointed by the mayor, reported the following settlement:

1. Negro projectionists will apply immediately for membership in L. U. 143.

2. These applications to be given favorable consideration and acted upon immediately by L. U. 143.

3. That the question of employing Negro workers be adjusted between L. U. 143 and the exhibitors to the best advantage of all parties.

Erpi Profits Addendum

The following statement culled from an official A. T. & T. organ may help those who experienced some difficulty in interpreting recent press statements anent Erpi profits:

"It (Erpi) has paid the research and development expenses incident to its business (approximately $5,700,000) and has paid it own way in every other respect. . . . it has earned net profits of $9,450,000, $4,000,000 of which has been paid to Western Electric as cash dividends. In addition it has collected and paid over to A. T. & T. $5,700,000 as royalties under patent licenses."

Eastman Net Income Up

Eastman Kodak Co. earned a net of $7,048,951, equal to $3.05 a share on the common, for the 24-week period ending June 15, as compared with a $2.91 net per share for the same period last year. Improvement noted during early 1935 has continued, the report states.

An extra of 25c a share was declared for the first time since 1931. Eastman business has so improved since 1933, when the stock was on a $3 annual basis that the dividend has since been raised twice to the present level of $5, the 1929 rate.

Motiograph Executive Changes

O. F. Spahr, for the past 15 years president of Enterprise Optical Mfg. Co., makers of Motiograph projectors, has resigned, effective at once. Succeeding him is F. X. Matthews, understood to be Harley Clarke's lawyer. Active management will be in the hands of E. J. Weinke, production; W. H. Hirschfeld, sales, and J. A. Neale, finance.

The new management announced the launching immediately of a vigorous production and sales policy.

Print Shortage Continues Acute; Fires Increase

Emphasizing anew the acute print shortage now existing in practically all film exchanges, the result of "economy" drives, is the recent order of Paramount to its exchanges to curtail simultaneous bookings in any given locality. The order is understood generally to reflect the growing number of exhibitor complaints anent damaged prints, the result of too many runs.

Distributors assert that current print shortages are due not to any reduction in the number of available prints per feature but rather to a steep increase

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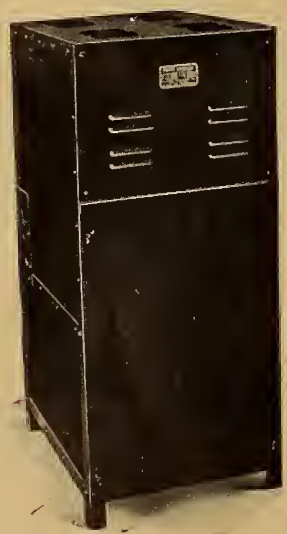

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—employs the copper oxide units, insuring long life and efficient operation—all with a maintenance cost that is nil.

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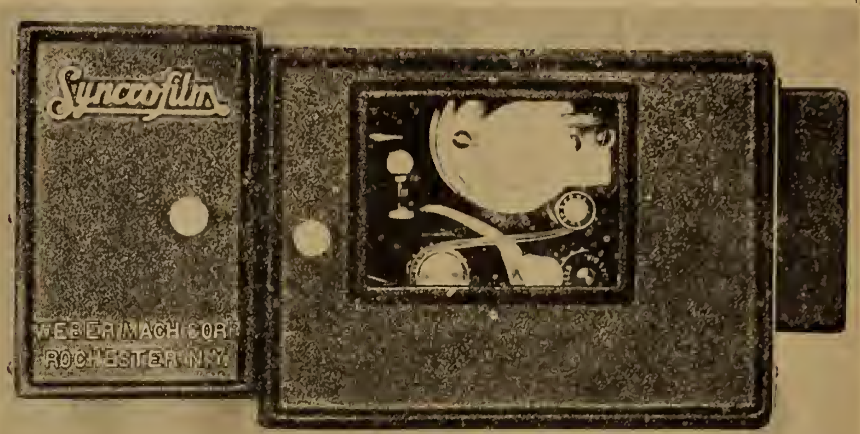
in day-and-date bookings, especially in the subsequent runs, plus a mounting list of dual-bill houses. I. P. is reliably informed, however, that the nnmher of prints per feature has been drastically cut, and reports from projectionists in the field, particularly in the smaller theatres, testify to the accuracy of this information.

I. P. has learned that the number of projection room fires, as compiled by distributors themselves, is greater today than ever before. Poor prints apparently is the only logical answer thereto.

Announcing The New SYNCROFILM *ABH* SOUND HEAD



Presented with the confidence that it will again justify the claim of Weber leadership in the sound field, the new ABH Sound Head represents the very latest advances in design, manufacture and high-grade materials. The ABH Sound Head reflects the experience of years in building successful sound systems.

In performance, too, the ABH Sound Head delivers the goods. No other sound head, irrespective of make or cost, can produce a wider range of quality sound. A few of the outstanding ABH features are:

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- Optical System—The very latest type microscopic lens designed for wide range reproduction.
- Exciter Lamp — Dual exciter lamps on swivel for immediate replacement.
- Case — Cast aluminum black enameled; glass door enables projectionist to watch film without opening door. Inside of case is illuminated.
- Drive—Flexible belts from motor; silent chain drive from sound head to projector.
- Sound Sprocket—Hardened and ground intermittent type.

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NEWSREEL SOUND QUALITY GREATLY IMPROVED

(*Continued from page* 13)

ogue was considered suitable for newsreels, and it was agreed to adopt this level as a "yardstick." Prints of a section of the "yardstick" were distributed among newsreel producers.

With the reduced level the projection room fader would remain unchanged for the news and the desired auditorium level would be obtained. The release date for the first news recorded according to the new standards was selected as March 4. This date allowed sufficient time in which to transmit the news of the change to all projectionists by service engineers and by publicity in the trade papers. With this ground work laid, the March 4 release was distributed with the warning notice shown in Figure 1.

Great Improvement Noted

After a month's interval it was interesting to observe that the maximum variation in level of all the newsreels measured at a subsequent conference was not more than ±2 db; and, of greater importance, there was a decided improvement in quality. Three of the reels were identical, one was 2 db. lower and another 2 db. higher. This close agreement has been verified by the records of the cue sheet of a New York

> PROJECTIONISTS
>
> Beginning with First Run Release
> MARCH 4, 1935
>
> Newsreels of all Companies will be Issued at Lower Volume Level
>
> WARNING
>
> Run this and Future Newsreels on Normal Fader Step Used for Feature Pictures

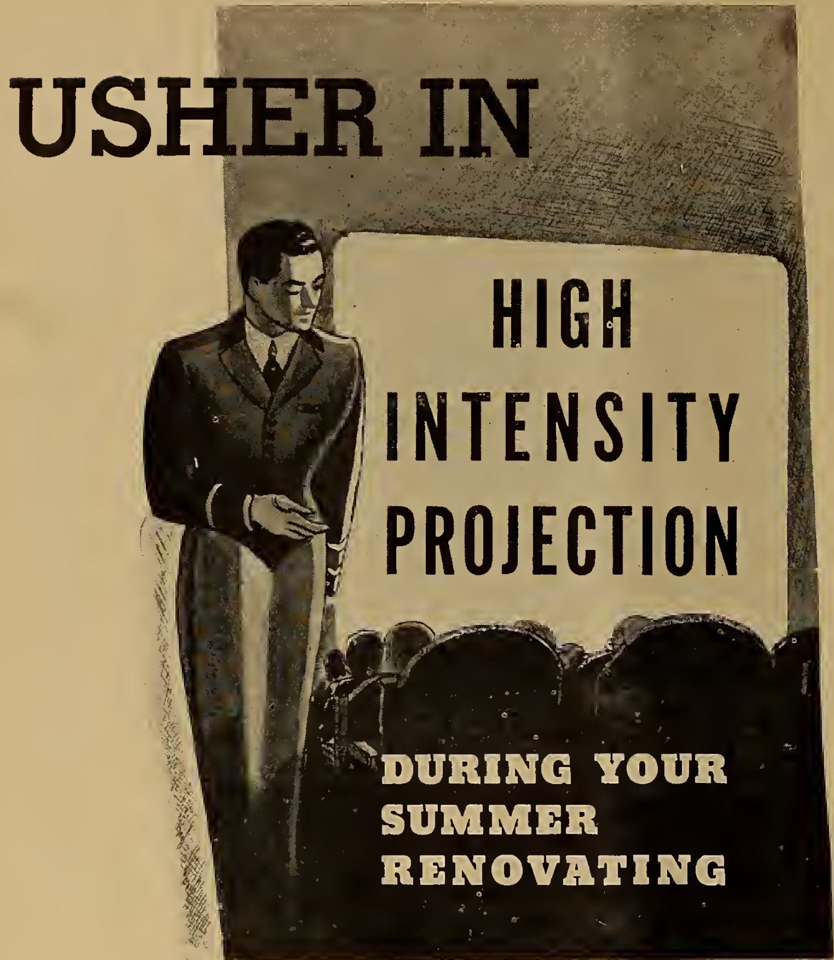
FIGURE 1
Notice distributed with initial release

newsreel theatre in which all newsreels are shown intercut as a continuous program. The maximum volume adjustment between subjects was reported as 2 db., whereas formerly the variation was as great as 8 db.

Now that the benefits of improved recording have been realized there is not likely to be a recession to the old methods. There doubtless will be instances when the feature level is slightly lower than normal, which will necessitate a change in the fader setting for the newsreel, but the quality of reproduction will not be altered. The continued cooperation of the newsreel producers, combined with periodic conferences every six months or so, will tend to assure a continuance of the benefits attained. Further improvements in sound quality will most likely ensue in the footsteps of this first advance.

The men in the field who gather the news are not affected by the change because, not having the same test and maintenance facilities available in the studio, nor the spare equipment, they must of necessity operate within conservative limits. They have to rely upon the home or district office to furnish their supplies, including film. A crew will use on an average of 50.000 feet of film a year, and some crews as much as 100,000 feet. They are constantly in touch with their local office, and receive practically all assignments from that source.

When completed, the stories are sent



DISCARD your obsolete, low intensity projection lamps. Patrons dislike groping blindly to their seats. They desire enough supplementary lighting for comfortable vision from the moment of entrance.

High Intensity Projection

Permits a comfortable level of general illumination. Improves the quality of black and white projection. Adds to the beauty and realism of color productions.

● There is a High Intensity Lamp, A.C. or D.C., for every theatre, large or small. There is a National Projector Carbon for every Projection Lamp.

Install High Intensity Lamps *this* summer . . . *they insure sustained patronage.*

NATIONAL CARBON COMPANY, INC.

Carbon Sales Division, Cleveland, Ohio

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Branch Sales Offices: New York ✦ Pittsburgh ✦ Chicago ✦ San Francisco

directly to the home office by air-mail: except when the story is not headline news: then the film is shipped by fast train. The cameraman reports the details of the story, including such items as camera angles and the number of feet shot. This report is attached to the film can and a duplicate is mailed at the same time. From it the newsreel editors can have a suitable script prepared for the commentator while the film is being developed.

Speed the Essence of Job

Advantage is taken of every means that will reduce the time interval between taking the story and reproducing it upon the screen in the theatre. Each story is assigned an identifying number when reviewed in the negative by the news editors. who select and edit the material for release. A title and a short synopsis of the story are dictated by the editor, and a record is kept of all stories received. About 20 per cent of the stories sent in are used for release. All are catalogued and stored in a vault essentially as they are. The selected stories are edited and cut, and a dupe negative and a lavender print are made. The dupe negative is made as a matter of precaution and, on occasion, is used to double the printing capacity to expedite the release.

The lavender "work" print is used for projection in scoring the comments, music, and sound effects if any are required. The commentator reads from a prepared script, and after a rehearsal or two the final sound negative is recorded. The original recorded sound may be used for a final release print or it may be re-recorded as an underlay when adding the comments.

The preparation of the news begins one day prior to the release date, and an entire reel is ready to be printed within 18 or 20 hours. The news subjects are arranged in definite sequence prior to making the reel, and when the first half of the reel is scored, prints are run off. The second half follows as quickly as possible, so that the release print is generally made up of two sections

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spliced together. For checking, a rush print is made from the sound negative and lavender print. The combined print has a negative of the picture, but this is satisfactory for the purpose.

The entire process is so thoroughly checked during the assembly of the reel that it is not necessary to await the complete print for a final check. The completed reels are dispatched throughout the country according to a definite schedule, and, if necessary, delivery is accomplished by airplane to maintain the proper schedule in the event that there is some delay in making up, or in cases of specials or flashes.

Constant Equipment Check

Special news stories of national importance are handled as "flashes," and in such cases, in order to eliminate the delay of awaiting "work" or "scoring" prints, the original negatives are used. In this way the stories are upon the screen within a few hours after the arrival of the negative. It is not at all uncommon in New York to see a newsreel flash of the deciding touchdown of an important football game in the theatre the evening of the same day.

The work of the sound department is continuous and not finished upon the release of the film. Reports that include the comments of the editor as well as the recording analyses are returned with every story, and by such means a continual check is available to the field crew upon the operation of their equipment. If, for instance, the density of the sound-track indicates a gradual change for two or three consecutive stories, the crew is informed to make the necessary adjustments.

Discussion:

CHAIRMAN FRAYNE: How do you take care of the more or less inherent difference of output between variable-density and variable-area films?

MR. HUMPHREY: Each newsreel company was furnished with a portion of a print, so that their prints, run in their own systems, could be checked against the sample.

CHAIRMAN FRAYNE: Was that done by changing the recording level or the transmission of prints?

MR. HUMPHREY: We left that to the newsreel studios. They do it in their own way, as they see fit. They make the check themselves and, as mentioned, do a pretty good job, because when the prints get to the theatres they seem to be quite uniform.

CHAIRMAN FRAYNE: I could not help but think, as I listened to Mr. Humphrey, that if the studios of Hollywood could do likewise, the public would be given a lot of relief.

At the present time we go into a theatre and hear a feature, or a reel of one, the sound volume of which is very comfortable. We hear and understand perfectly. Then all at once the picture changes to a *Mickey Mouse*, or a newsreel, or to something else. Suddenly there is a tremendous change in the output of the horns, and a great deal of discomfort is caused among the patrons, which must certainly be reflected eventually at the box-office.

PURCHASING POINTERS ON PROJECTION EQUIPMENT

(*Continued from page* 13)

period shall be 12 months from date of shipment *from our factory*. We will not be liable for consequential damage in case of any failure to meet the conditions of our guarantee.

Pay particular attention to the statement about proper operation; note that the guarantee extends for 12 months from the time the unit *left the factory*, and *not* from the date of installation. Many guarantees, like the foregoing sample, require the return of receipt cards. *Do not neglect this.* I have seen many such cards lying around theatres.

Get Guarantee—In Writing

The next time you buy any electrical apparatus insist upon the salesman going over the terms of the guarantee with you—and *get it in writing*. Reactions to equipment trouble vary, but usually the equipment is held at fault. Here is some typical correspondence anent a very troublesome motor generator set.

Electric Manufacturing Co.:

I use one of your m.g. sets for running my mirror arc lamps. Yesterday it began to smoke, and by the time I got it shut off it had a peculiar odor. When I tried to restart it the fuses blew.

My machine is only 6 months old, and the salesman told me it was guaranteed for 1 year. Please send me a new machine at once. I'll return this defective one to you. I am using an old rectifier temporarily, so please hurry. BIJOU THEATRE

Bijou Theatre:

We regret to hear that your m. g. evidently has burned out. In accordance with the provisions of our printed guarantee, copy of which is enclosed, we suggest that you return the m. g. to us by prepaid freight. We will examine it and determine the cause of the trouble.

ELECTRIC MANUFACTURING CO.

Electric Manufacturing Co.:

I received your letter, and I don't like the way you want to handle this trouble. The salesman told me at the time of purchase that this machine was positively guaranteed, and that you would replace it if it went bad. I am sending it to you and will expect you to repair it, no charge,

SUN-ARC CARBONS
"Best by Test"
Improve projection and—SAVE MONEY
SUPREX QUALITY Carbons for new DC-HI lamps.
AC High Intensity Carbons.
•
Suprex Carbons provided with holes for use with Suprex Saver, to be ready soon.
•
Hi-Low and High Intensity Carbons—provided with holes—ready for use with the Patented Saver (furnished free of charge).
LOW INTENSITY Carbons—REGULAR and SPECIAL.
Studio-Process Carbons, etc.
ASK FOR NEW PRICE LIST
CARBON PRODUCTS, INC., 324 West 42nd Street, New York City

Does Your Supply House Offer These Advantages
*Equipment of the Highest Quality *Prompt Courteous Service
*Ample Stocks *Economy
? If you trade at your National Theatre Supply branch, all these advantages are, of course, yours. Day and night your National branch is ready to serve you from its ample stock ranging from a small screw to a complete projection installation. National offers genuine Simplex parts only—and expert projection repairing always.
Get the National trading habit. Use the National branch as your equipment headquarters, and seek its advice on all equipment problems. It will pay you large dividends in superb equipment performance and freedom from service troubles.
NATIONAL THEATRE SUPPLY CO.
92 Gold Street INC. New York, N. Y.
or office nearest you

DA-LITE

SCREENS

8 Types
No Two Alike

REGARDLESS of the width of your house or the kind of light source you are using, you can insure best possible results with a new DALITE Screen made to meet your requirements.

Ask your dealer—or write direct to us.

DA-LITE SCREEN COMPANY, INC.

2723 No. Crawford Ave.
Chicago Illinois

because it must have been defective or it would not have burned out.

Bijou Theatre

Bijou Theatre:

We have carefully examined your m. g. #463,721, which was shipped from our plant 14 months ago, and fail to locate any defect which would cause it to burn out. The trouble was undoubtedly due to overload. The commutator shows every indication of having been extremely hot. Other parts are in the same condition.

We have repaired the set and are returning it C.O.D. for the transportation and repair charges.

Please let us know just what load you have on the machine, the make of lamps, the size and grade of carbons used, and the reading on your volt- and ammeter. Unless the overload is reduced, you will have the same trouble with the repaired machine.

Electric Manufacturing Co.

Electric Manufacturing Co.:

Your bill for $75 is nothing but plain robbery. You guarantee your machine, then when it goes bad you won't make good. I will make it my business from now on to tell all the projectionists in this part of the country just how poor a set you have, and how you refuse to back your guarantee.

Bijou Theatre

Bijou Theatre:

We are sorry that you feel as you do about this m. g. trouble. However, we cannot be responsible for trouble resulting from overloading. Please answer our questions regarding your load before you have further trouble, as we are anxious to be of assistance to you regardless of your feelings toward us.

Electric Manufacturing Co.

Electric Manufacturing Co.:

I have two "Rectarcs" and use SRA 13 and 8 mm. carbons. The meters show 36 amperes, 80 volts. At first I used the regular 12 and 8 mm. carbons, but these did not give enough light. A salesman told me to use the SRA carbons, and they sure give plenty of light.

Bijou Theatre

Bijou Theatre:

Your letter confirms our opinion of an overload on your m. g. set. You have a 25-25 ampere set which is large enough for the lamps and the carbons you were originally using, which should be burned at from 21 to 25 amperes.

However, your m. g. is too small for the SRA trim you are using. If you cannot change carbons and reduce your load to under 30 amperes, you will have to get another generator. We suggest that you immediately get the advice of your supply dealer on this problem, before you have further trouble.

We hope you will not feel unkindly toward us, as we are sure that you are fair-minded enough to agree that the generator was not at fault.

Electric Manufacturing Co.

A substitute power supply is the only breakdown insurance. Projectionists in large cities may sniff contemptuously at the little fellow in the "sticks," yet I have had many emergency calls from the best theatres in large cities. In one so-called de-luxe theatre I happened to inspect the generator on a casual call and noted a severe overload.

Purchasing Pointers

The particular point that I wish to emphasize is that in order to get real service it is necessary for the user of electrical apparatus (which means you. Mr. Projectionist, who has to stand the gaff) to do several things. Act on the following suggestions:

1. Should a salesman make assertions which place his equipment far ahead of similar equipment on the market, *make him prove it.*

2. When buying equipment, see that it is properly installed, properly operated and given competent maintenance.

3. Be sure to get a copy of the manufacturer's guarantee. *Read it over,* and then comply with any requests made.

4. When reporting trouble, give the manufacturer the machine number and *complete details* of your equipment type, the load carried and the power supply. Try to place yourself in the position of the factory service man.

5. Be open-minded in your dealings with the manufacturer. True, machines can be out of order—and you may be wrong.

6. Before buying apparatus calling for an appreciable outlay of money, look up the financial rating of the seller to determine his ability to back up a guarantee. A guarantee is no better than the company back of it.

Only High Intensity Arcs Give
HIGH INTENSITY PROJECTION

H&C INC.

The Lamp With Accurate Arc Regulation

H. C. 10 Super Intensity Lamp

Descriptive booklet on request. Write for it to

HALL & CONNOLLY

24 Vandam St. New York, N. Y.

International PROJECTIONIST

OCT 10 1935

Erpi Abandons

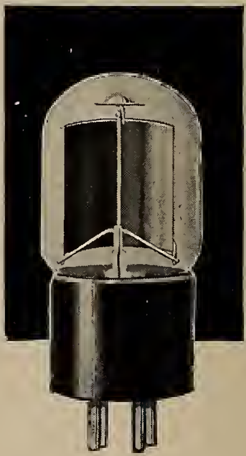
Extended Servicing Plan

STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING SYSTEMS —I. P. DISAPPROVES REFLECTOR GLASS GUARDS—DOUBLE-REEL SITUATION — SOUND RECORDING PROCESS — S. M. P. E. PROJECTION REPORT—NEW EQUIPMENT—NEWS OF THE MONTH — CRAFT ITEMS

September 1935
Vol. 9 No. 3

A magazine devoted to better visual and sound reproduction

25c a copy
$2.00 a year



MOST projectionists are willing to be held strictly responsible for quality of sound reproduction and screen results, provided they are given the proper tools with which to work. . . . Those who pick their own equipment may confidently choose Visitron Photo Cells. Because of superior quality, Visitrons make the job easier for the projectionist and more satisfactory to the management. Once tried—always specified!

VISITRON

OUTSTANDING IN VALUE!

PHOTO ELECTRIC CELLS

MANUFACTURED BY

G-M LABORATORIES INC.

1735 Belmont Avenue Chicago, Illinois

ASK YOUR SUPPLY DEALER FOR *VISITRONS*—BY NAME

Better Projection

Greater Economy

Than You Have Ever Enjoyed in Your Theatre Before is Yours with The

BRENKERT ENARC

AUTOMATIC PROJECTION LAMP

THE BRENKERT ENARC is used in the country's most important theatres and is continuously winning the favor of projectionists, theatre owners and managers by its champion screen performance, accurate and trouble-free operation and thorough dependability. All at a low operating cost and, due to Brenkert's long experience and superb manufacturing facilities, at a very reasonable initial cost.

Sold by distributors covering the country. Write or phone the Brenkert distributor nearest you for a demonstration in your theatre.

The name BRENKERT on a projection lamp is your guarantee of quality—fine projection, complete reliability and economy.

BRENKERT LIGHT PROJECTION CO.

Engineers and Manufacturers

7348 St. Aubin Avenue
Detroit Michigan
U.S.A.

THE *Peerless*

MAGNARC

TRADE MARK REG.

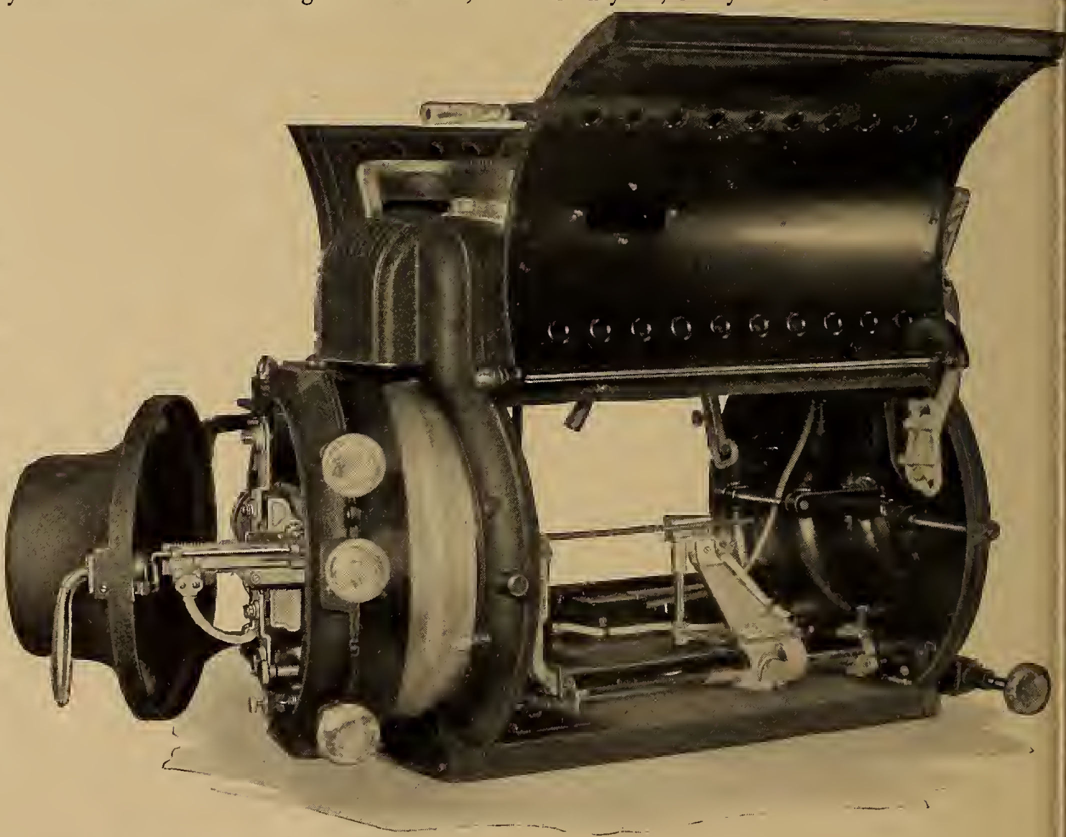
CHECK FACTS!

WHEN we tell you that the Peerless Magnarc has caused a complete revolution in the lamp manufacturing industry—we mean it. When we tell you that the Peerless Magnarc has *had*, for over a year, every feature of construction and design now being heralded by others as revolutionary, new, advanced, triumphant, etc.—we mean it also.

These facts undeniably prove that the only wise choice, the only economical choice, the only *safe* choice to protect your investment, is a Peerless.

The Nation's greatest theatres have discovered the real economy of Peerless, for no purchaser ever had an obsolete model of the same type on his hands.

Peerless design ever has been advanced and creative. You have our promise it will always remain so in the future.



It costs no more to own a Peerless, so—WHY EXPERIMENT?

WRITE FOR LITERATURE

MANUFACTURED BY

J. E. McAULEY MFG. CO.

552-554 W. ADAMS ST., CHICAGO, ILL.

o—o—o—o—o—o

"THE WORLD'S LARGEST MANUFACTURER OF PROJECTION ARC LAMPS"

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

Volume 9 SEPTEMBER 1935 *No. 3*

Index and Monthly Chat	5
Erpi Abandons Its Plan for All-Inclusive Servicing JAMES J. FINN	7
I. A. Granted Jurisdiction Over All Non-Affiliated Theatre Workers	8
Step-by-Step Analysis of Sound Reproducing Equipment, XIV AARON NADELL	10
Technical Aspects of the Recording Process R. H. TOWNSEND	13
I. P. Withdraws Approval of Reflector Shields	14
Screen Brightness Symposium Topics Cited by S. M. P. E. Committee	15
Model Room Layout by S. M. P. E. Projection Committee	16
Double-Reel Progress Stalled by Exchanges and Legislative Items	19
What's New in the Supply Field?	20
Metal vs. Nitrocellulose Film	20
News of the Month	21
Accurate Film Gauge	22
News Notes	
Technical Hints	
Miscellaneous Items	

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420

MONTHLY CHAT

ON ALL sides one hears this question asked: If such fine results are had with Suprex 7- and 8-mm. combination, why not go to a 9- and 10-mm. trim and obtain even better results, including elimination of present high-intensity equipment drawing 125 amperes?

This query is not even theoretically sound. The present largest Suprex trim effectively covers the aperture and gets all the light possible through the lens. A larger trim will be in order only if a much faster lens is produced. Our British friends, the Cooke Company, have produced an $f/1.8$ lens which while O. K. for speed is reported very poor on correction.

The craft must learn to think of the most effective projection chain in terms of *both* arc and optical system. The neck of the bottle is the optical train.

STILL operating are many low-intensity lamps that were converted for Suprex operation. Conversion was first advanced by I. P. as a means for forcing lamp manufacturers to come across with a D. C. Suprex unit. Said manufacturers having delivered, there is no longer any excuse for the existence of conversion jobs, which were and are merely stop-gap equipments.

Just figure out the single item of mirror breakage costs on such outfits.

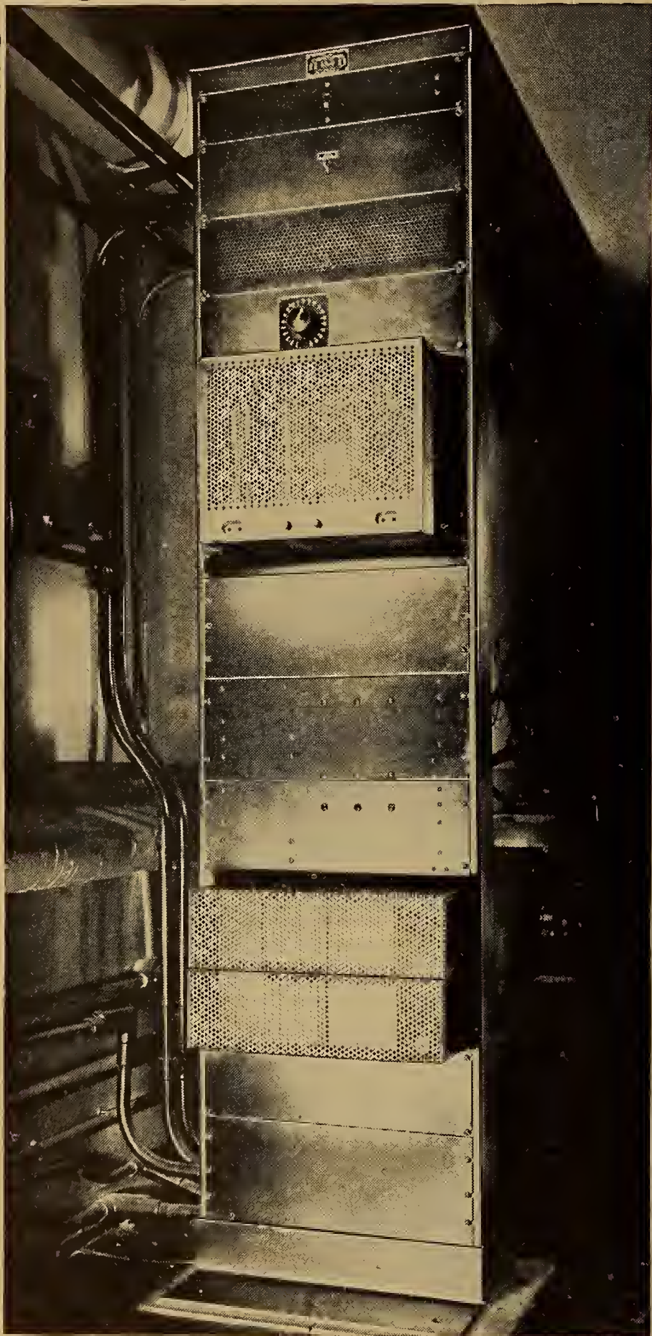
WHICH reminds us that the battle between the rectifier and the motor generator manufacturers still is raging. Before the latter could say "arc" the rectifier boys had cut a pretty wide swath, and even the subsequent worthy endeavors of the generator crowd failed to overcome the advantage scored by the former. Of course, the generator man has demonstrated a positive passion for hiding his light under a bushel; while no bushel large enough has been found to dim the light of the rectifier fellers, who are up and at 'em all the time and shouting the worth of their wares. 'Twas ever thus.

I. P. has withdrawn its endorsement of some months ago pertaining to the so-called Mirror Guards which were intended to protect mirrors against pitting. I. P.'s opinion of this equipment item has changed to the same extent as the worth of the guards.

PAID advertising copy means no more to us than does our right arm, as our readers know. But this is not the reason we cite here the addition to I. P. advertising ranks this month of the Supreme Instruments Corp., manufacturers of all types of testing equipment. This emphasizes anew our stand that sound systems are no longer a mystery and that all the equipment necessary for a first-class servicing job by the craft is available.

What are we waiting for?

NO 2 BOX OFFICE IN THE AMPLIFIER



Money-Making Step-Up

ALMOST any amplifier can step-up the volume of sound, but it takes a mighty fine one to avoid stepping-down the quality and box-office.

That's why RCA put so much thought and effort into making the finest amplifier it could devise for its High Fidelity Photophone equipment.

This amplifier handles the output of the sound head without distortion. It steps up the volume to the level you need and preserves all the most delicate tones and overtones that are so essential for faithful reproduction, audience satisfaction.

This is a triumph of great engineering.

It is also a masterpiece produced by practical men, for practical men to use.

You see the evidence of practicality in the absence of batteries, of motor-generators; in the use of standard tubes; in the standard mounting racks that can be placed against a wall, since all units come out from the front; in simple provisions for meeting emergencies; in thorough precautions to make emergencies as rare as possible.

Add all these things up. Plus them with a maintenance and service schedule that gives you expert attention when you need it, at a fair price. The combination means Box Office set-up—money made with the most efficient use of money and materials.

AMPLIFIED POINTS

1. All AC operated. Each unit complete in itself, without separate eliminators.
2. Each unit fits standard channel iron rack, and is installed from front. Rack can be placed against wall, saving space.
3. Standard RCA Radio tubes, low in price, available anywhere.
4. No amplifier in sound head and so no troubles with vibration, oil, dirt. Amplifier can be placed where convenient, almost any distance from sound head.
5. Optional remote volume control permits adjustment of volume directly from auditorium.
6. Reliable, long-life rectifiers for speaker fields and exciter lamps.
7. Separate voltage and power amplifier in same rack. If power amplifier goes, continue show with voltage amplifier. Should there be any changes in recording in future, amplifier can be easily, economically brought up to date.
8. Simple, reliable, swift change-over relay.
9. Projectionists have what it takes to get the most out of the amplifier.

SENSE MAKES DOLLARS

Hit films and attention-arresting promotion can go a long way toward overcoming imperfect sound. But why handicap your bookings? It's good dollar-making sense to take all the RCA High Fidelity Photophone apparatus can give you.

RCA PHOTOPHONE

PHOTOPHONE DIVISION • RCA MANUFACTURING CO., INC., CAMDEN, N. J. • A RADIO CORPORATION OF AMERICA SUBSIDIARY

INTERNATIONAL PROJECTIONIST

VOLUME IX NUMBER 3

SEPTEMBER 1935

Erpi Abandons Its Plan For All-Inclusive Servicing

By JAMES J. FINN

Erpi has abandoned its idea of establishing an engineering service to cover all phases of theatre maintenance, for the time being at least. The reasons are interesting but, given to this department "off the record," cannot be aired at the moment. When Erpi disclosed . . . that it was giving consideration to introducing the new . . . service, reports were broadcast that the company intended going into the equipment business. Not true then, and still not true, the reports, nevertheless, increased the opposition which Erpi's plans met. This, however, is not the reason why the idea is being shelved now . . . MOTION PICTURE DAILY.

THUS we come to the end of the trail of Erpi's fantastic scheme to sink its tenacles deeper into the motion picture industry. As usual, Erpi ducked a direct announcement to the trade at large, electing to let the news of the blowup of its all-inclusive service plan seep into the field through the medium of an "off the record" statement to a publication which seems to be particularly favored by Erpi in this respect.

Of course, Erpi need not have made any announcement on this point, for the extended servicing plan died aborning. Feverish efforts to instill life into the corpse were made through the release of absurd press items anent the "great success" of the scheme, but these "plants" were indicative only of a gullible, if not supine, trade press.

A check-up of the "off the record" statement elicited from Erpi the comment that they still were undecided but would "reach a definite decision" on extended servicing within the next "sixty or ninety days." Erpi might well spare itself such mental pains, because the plan is frigid right now.

INTERNATIONAL PROJECTIONIST is proud of the part it played in exposing this menace to the welfare of projectionists, supply dealers and equipment manufacturers. I. P. stood alone among all the other trade papers in its battle against this Erpi plan. Erpi learned. to its evident great surprise, that I. P. was not awed by its little-brother relationship to the colossal A. T. & T. Co. The latter's proper field, I. P. holds, is, always has been, and undoubtedly will continue to be communications, in which it has more than enough problems to occupy its attention at present.

Particularly amusing was the withdrawal of Erpi advertising from these columns. This old trick, so dear to the hearts of all utility interests, served only to heighten the opposition of I. P. to any extension of Erpi influence in this field. The attention of I. P. readers is directed to the fact that this retaliatory measure was instituted simply because I. P. kept its readers informed. I. P. trusts that its readers will repay Erpi in kind.

The major portion of the credit for the defeat of this all-inclusive servicing scheme, however, is due to the combination of Labor, supply dealers and manufacturers, all of whom exerted strong opposition to the Erpi plan. In fact, the significance of this Erpi defeat lies in the fact that notice has been served on the field of the immense power wielded by this combination.

I. P. again congratulates RCA upon its attitude throughout this battle over extended servicing. In sharp contrast to Erpi, RCA came forward with a detailed statement of its plans, promised non-interference with Labor and gave formal assurance that it would not encroach upon the rights of either supply dealers or manufacturers. In the same measure that Erpi's attitude deserves condemnation, that of RCA merits commendation. I. P. trusts, also, that the craft will re-

member this friendly gesture and will repay RCA, too, in kind. These fights are dollar-battles, and the opposition must be hit where it hurts most—on the sales sheet.

I. P. never placed any credence in Erpi promises that it would not enter the manufacturing and supply fields. The Erpi plan, as far as it could be pieced together, called for all-inclusive servicing of a theatre from the roof to the cellar, including, of course, the projection room and the stage. Erpi representatives, it was stated, would inspect the theatre and merely make "recommendations" on equipment, with the theatre itself doing the purchasing just as it does now.

I. P. finds it extremely difficult to believe that the benevolent Erpi organization would long be content to "recommend" equipment and complacently watch the orders and cash therefor go elsewhere. The evolution of such a plan would see Erpi (or any other organization similarly situated) making a definite bid for such lucrative business. Erpi's record to date with respect to replacement parts is ample basis for such expectations. Even today Erpi either makes, or exerts great influence over the sale of, much equipment for the theatre.

Finally, I. P. is extremely interested in this "off the record" reason for Erpi's abandonment of its extended servicing plans. "Off the record" is no reason at all, although it does suggest an air of mystery and operates to make unnecessary any explicit reason for the Erpi backdive. Maybe the phrase is a new and curiously involved synonym for a plain, old-fashioned flop.

In other words, Erpi laid an egg.

* * *

NOW that the battle against extended servicing by Erpi is won, I. P. has no intention of tapering off its demand that the projectionist craft assume direction of what might be called "ordinary" sound equipment servicing. The right of the craft to work of this character is as well-defined as is Erpi's, if not better by reason of the fact that it lies within the jurisdiction of the projectionist, who has to operate and is responsible for a continuous show.

Those profits which Erpi or any other company has been able to amass through this kind of work might just as well stay with the craft as travel to the sound companies. We believe in a reasonable amount of service, of course, but we are vitally interested in who gets paid for it. We vote for the craft.

We are convinced that the craft can do just as good a service job as that done by Erpi, and for considerably less money. Sound equipments no longer are the mysterious bottled-up units that they were in 1928; and every projectionist in the land can become privy to the servicing requirements of his own equipment.

* * *

JUST how much service is required by other theatre sound equipments? International Projector, S. O. S., Weber, RCA and several other companies today sell complete sound picture equipments that seem to require no servicing at weekly rates ranging from $10 to $40 per theatre. How do they do it? The answer is, first, that there are no hocus-pokus circuits requiring too much panel space and wiring to confuse either the operator or the service man. Second, they are designed and constructed for rugged day-in-and-day-out operation under even the severest conditions. Finally, all these companies make available to the purchaser detailed data relative to the systems, instead of trying to seal-in and hide away important units.

All the aforementioned companies can show actual operating records of equipments covering one year which entailed no service charges and a minimum of replacement parts expense. If they can do it, these purveyors of what Erpi has occasionally termed "bootleg" equipments, why can't Erpi? Incidentally, Loew Theatres and Warner Theatres seem to get along nicely without Erpi service.

* * *

ONE other aspect of Erpi's relations with the exhibition field engages our attention. Extended frequency range equipments (termed "Wide Range" by Erpi) have enjoyed some vogue during the past several years. I. P. believes in the principle of extended frequency range equipments and has so advised the many correspondents who solicited its opinion thereon. The application of the principle, however, is something else again.

Consider, for example, any de luxe theatre which in 1928 or thereabouts paid $40,000 for the 8-B and 9-A Erpi sound outfit. Add to this the tidy sum of $40 per week for service during the past six years (a total of $12,480), not forgetting interest and other finance charges. The total to date, then is about $53,000 for such an installation, from *one* theatre, excluding the fancy prices charged in the interim for replacement parts—such as $65 for a single tube or the like.

Now in the year 1935, Erpi makes considerable noise about the advantages of its Wide Range equipment. Fine. How much do they want for a real classy, bang-up job of converting the old 8-B and 9-A system? Why, they want only about $5,000. Mind you, this is really a *conversion* job, not a new installation.

Erpi makes much of the point that its Wide Range job is a "tailor made" proposition, the individual needs of a given theatre being suited in every particular. We agree that the job is "tailor made," our idea being that a conversion job involving the matching of old and new sound equipment is akin to tailoring a suit with the pants by Goldberg, the coat by Mulcahy, the vest by Luigi, and haberdashery by Ipsil.

Thus, for the astronomical figure of $60,000 (which may be an insignificant bundle to Erpi, accustomed to dealing in telephone numbers) plus finance charges and replacement parts costs, a theatre may wind up with an Erpi Wide Range job with all the fixings and trimmings—*except that the theatre does not own even a screw of the outfit.* And still people want to know what's the matter with the picture business!

On the other hand, RCA, International Projector, S. O. S., Weber and many other manufacturers will supply a complete extended frequency range equipment, engineered from the ground up for precisely that purpose, and at least as good as Erpi's outfit, *for about $2,500, without compulsory servicing, and on outright sale!*

* * *

TWO months ago[1], in discussing Erpi profits of nine millions of dollars, this writer stated that Erpi was welcome to these paper profits; and immediately after he posed the question: What large sound equipment company plans to ask

[1] "Sound Equipment Profits," I. P. for July, 1935, p. 8.

(*Continued on page* 30)

A. F. of L. Grants I. A. Jurisdiction Over Unaffiliated Theatre Labor; 60,000 Membership Possible

The I. A. has won the formal approval of the Executive Council of the A. F. of L. in its application for jurisdiction over an additional 30,000 theatre workers in the U. S. and Canada. I. A. charter control now extends to ticket takers, cashiers, ushers, porters, wardrobe custodians and all other unaffiliated theatre workers.

No announcement of organizing activity has come from the I. A. as yet. Should such a campaign be attended with success, the I. A. membership could easily rise to 60,000.

A REAL FIND

LITERALLY, the news about Eastman Super X spread like wildfire. Never has a film "caught on" faster, or been more widely adopted in so short a time. The reason: Super X is a real find for the cinema world. Introducing new standards of speed and photographic quality, coupled with rare versatility, it represents a major advance in raw-film research . . . a true contribution to the art of the motion picture. Eastman Kodak Co., Rochester, N.Y. (J. E. Brulatour, Inc., Distributors, New York, Chicago, Hollywood.)

EASTMAN *SUPER X*

PANCHROMATIC NEGATIVE

Step-By-Step Analysis of Sound Reproducing Equipment

By AARON NADELL

XIV. Western Electric 200A and 209A Panels

ONE of the most convenient arrangements for coupling loud speakers to the output impedance of an amplifier is represented by Figure 1. The apparatus there diagrammed serves two distinct and useful functions: (1) the number of speakers needed by any given theatre can be matched accurately as to impedance with the output impedance of the amplifier. Through this control panel the same amplifier can be made to supply two 15-ohm speakers in one theatre and six in the theatre across the street, with equally satisfactory impedance relationships in both cases. (2) the volume drawn from different speakers in the same theatre can be varied to a very wide degree without impedance mismatch, affording a flexibility in speaker output that is extremely useful when good distribution of sound must be secured in an auditorium offering difficulty.

Fig. 1 has no power supplies. It has two sources of sound input, shown at the left of the drawing, and seven channels of sound output, the terminals for which are numbered 1 to 6 and marked "mon." at the lower edge of the diagram.

The Input Circuits

Fig. 1 is designed to be used, if necessary, with a double-channel theatre system, that is, one having an emergency system amplifier, and therefore has double input connections, labelled "R" (regular) and "E" (emergency). The regular input terminals are at the upper left of the drawing, marked A and B. The input line may be traced right, down, right, down and right to a point of junction with three other wires. One of those other wires runs straight up to Terminal 13, the lower terminal of the 7A autotransformer. The third wire to this junction point may be traced down, right and down to the ground terminal. The fourth will be traced later, being properly no part of the input circuit.

The input through Terminal B runs straight down to the R-E switch key, which couples Fig. 1 to either the regular or the emergency system amplifier. As shown, this switch is in neutral position. The circuit may be traced from Terminal B down to the upper left-hand terminal of the switch, then right, down through the closed arrowhead, and left, down, stopping at another switch terminal which may be ignored for the present; and down, right through R-1, which is 500 ohms and matches the output impedance of the system amplifier; thence right, up, left, up, left, up, left, up and left to Terminal A.

Consequently, with this switch in open position, as shown in the drawing, a dummy load of 500 ohms is connected across the amplifier output.

If this switch be now thrown to "Regular" input, there is no change in the connections of Input Terminal A, which is not wired to the switch, but the connections through Input Terminal B become as follows:

Down as before to the upper left-hand prong assembly, but thence to the long bottom prong of that assembly (shown open in the drawing), and thence up, right, up a bit and right all the way across the drawing, and down to Terminal X, of the two terminals marked X and Y, and also "Eq.," in the extreme lower right-hand corner of Fig. 1. These terminals were originally intended for connection to an equalizer, or tone control filter, but being no longer used for that purpose, are simply strapped together.

The circuit we are tracing, therefore, continues across the strap (not shown in the drawing) to Terminal Y, and thence up, and left across the top of the drawing to Terminal 1 at the top of the 7A autotransformer. This is the circuit from Input Terminal B. Input Terminal A is permanently wired, regardless of switching, to Terminal 13 at the bottom of the same autotransformer. Hence, throwing the R-E switch to "R" connects the 500-ohm impedance of this autotransformer across the amplifier output.

Under these circumstances, the 500-ohm dummy load, R-1, is no longer tied to the Regular input, as may be seen by tracing backward from the left-hand terminal of that resistor:—left, up, stopping at the second terminal from the bottom on the left-hand side of the switch, thence up and left to the second terminal from the top. This prong, the switch being set at R, is now open, whereas with the switch at neutral, as the drawing shows it, this is the prong that connected the left-hand side of R-1 to the Regular input terminal, B.

This switch has duplicate contacts throughout, the right-hand side being in parallel to the left-hand side. Trace downward through input terminal B to the upper left-hand terminal of the switch, and then right across the jumper to the upper right-hand terminal. Thence, with the switch at neutral as drawn, to the second right-hand prong from the top, down, stopping at the second right-hand terminal from the bottom, and then down, left and down to the left-hand side of the dummy resistor.

With the switch set at R the circuit is: from Input Terminal B to the top right-hand prong as before, thence to the long bottom prong of the upper right-hand assembly, and up, right across the drawing and down to Terminal X; through the strap to Terminal Y, and up, left across the top of the drawing and into the autotransformer at its top terminal.

The two top prong assemblies of the switch are therefore wired to function in parallel, and to connect the output of the Regular amplifier to either the dummy 500-ohm load, or to the 500-ohm primary of the autotransformer, as desired.

With the switch set at E, or emergency, the short, vertical double arrowhead in the drawing pushes the long prongs of the lower assemblies downward, but leaves the upper assemblies undisturbed in neutral position, as shown. From Emergency Input Terminal C the circuit as drawn is right to the ground wire and up to the autotransformer, with a branch running leftward to the right-hand side of the dummy resistor. From Emergency Input Terminal D up to the switch, and through the connections as

drawn to the left-hand side of the dummy load resistor.

However, with the switch thrown to "Emergency" the circuit is: upward from D to the two bottom prongs; thence to the two long prongs of the lower assemblies; thence upward to the wire that runs right across the drawing and down to Terminal X; through the strap to Y and back up to the top of the autotransformer.

The complete action of the R-E switch, therefore, is as follows: with the switch set at neutral, as the diagram shows it, both amplifiers are connected across a 500-ohm dummy load. With the double arrowhead moved upward, the upper prong assemblies act in parallel to connect the R amplifier output across the full winding of the autotransformer, leaving E amplifier across the 500-ohm resistor. With the double arrowhead moved downward, R amplifier is again connected across the dummy load, while the two lower prong assemblies act in parallel to connect E amplifier across the autotransformer.

Modification of R-E Switch, Fig. 2

The reader whose sound installation includes the panel of Fig. 1 likely will find on inspection that it is not wired exactly as shown therein. When this panel is installed with a system that does not include an emergency amplifier, or with a system that does but also has a "systems switching panel," the R-E switch has no function to perform except that of an "off-on" switch. Nevertheless, if set wrong or moved by accident, it will cut off sound. Therefore, the wiring of that switch is modified, with such systems, as shown in Fig. 2, the object being to connect sound input from R terminals to the autotransformer regardless of whether that switch is thrown to R or to E. Only when it is in neutral position does sound cut off and the dummy load connect across the amplifier output.

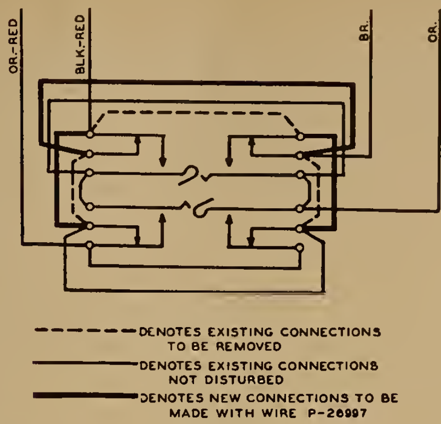


Figure 2

Comparing Fig. 2 with Fig. 1: the orange-red wire of Fig. 2 is the one that leads to Input Terminal B of Fig. 1. The black-red wire of Fig. 2 is the one that leads to Fig. 1's Input Terminal D, and is therefore idle and unused with the wiring of Fig. 2. The orange wire of Fig. 2, in Fig. 1 goes to Equalizer Terminal X; while the brown wire of Fig. 2 leads to the left-hand side of R-1 dummy load resistor.

Only the orange-red lead need now be considered as an input, since there is no emergency amplifier; or if there is one, it is switched at the systems switching panel and only a single input comes to the circuits at present under consideration. With the switch as shown in Fig. 2 the input circuit is: from the lower left-hand terminal of the switch to the second left-hand prong from the bottom; across the jumper to the top left-hand prong; to the second prong from the top; across the jumper to the second *right*-hand prong from the top, which is connected solid to the brown wire leading to the dummy resistor. A parallel circuit along the right-hand side of the switch duplicates this connection of the input to the 500-ohm load.

With the switch as in Fig. 2 operated to move the long upper prongs, leaving the long lower prongs as shown, the input may be traced: from the lower left-hand terminal to the second left-hand terminal from the bottom; to the top left-hand terminal through the switch contacts to the third left-hand terminal from the top, around the jumper to the third *right*-hand terminal from the top; down to the fourth right-hand terminal from the top, and out to X, which, as in Fig. 1, connects through Y to the top of the autotransformer. A parallel circuit follows the right-hand side of the switch.

Operating the switch-key to E leaves the top assemblies as drawn, and moves the long lower prongs downward: the input circuit then is from the lower left-hand switch terminal to the long prong of the lower left assembly; thence up through the jumper to the long prong of the upper left assembly; thence around the jumper to the long prong of the upper right assembly; thence down through the jumper to the long prong of the lower right assembly, and out to X. The parallel circuit is from the lower-left terminal of the switch across the jumper to the lower right terminal, and through the lower right assembly to the long-prong of that assembly, and out to X.

Input Impedance of Fig. 1

The load connected across the amplifier by the switching action of Fig. 1

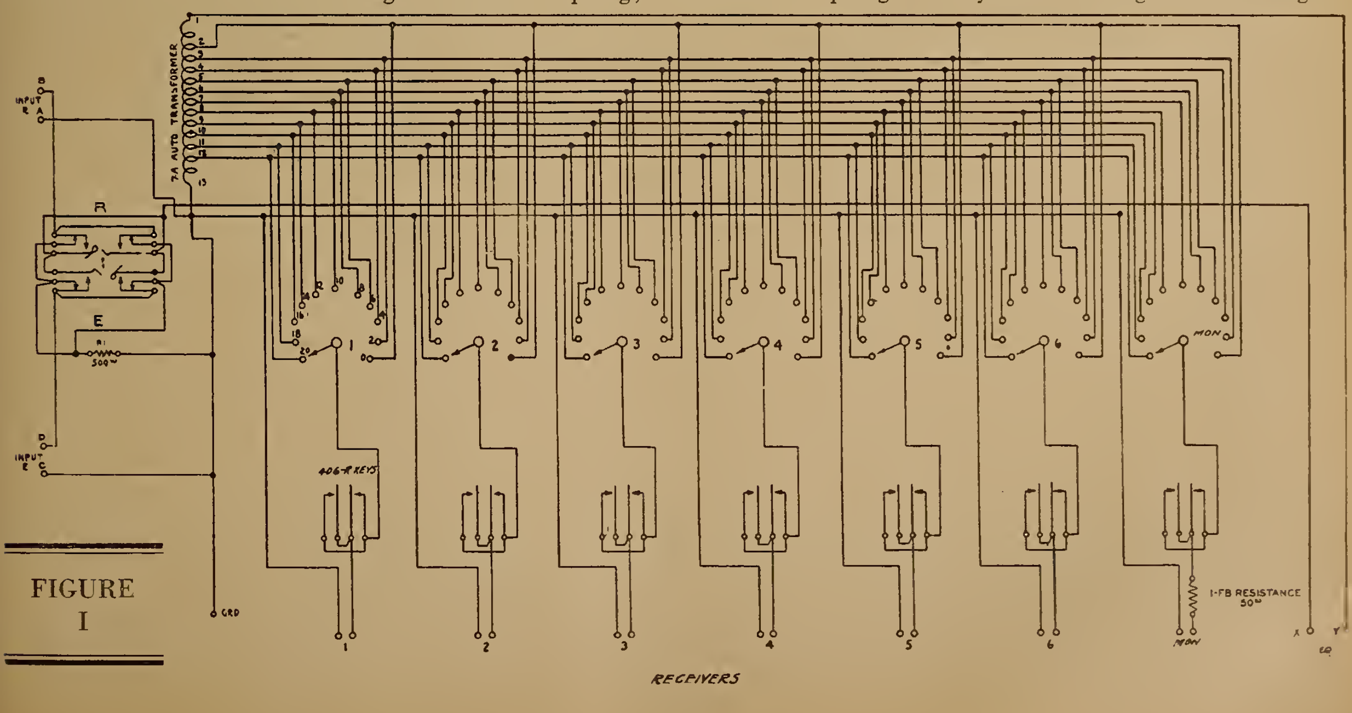


FIGURE I

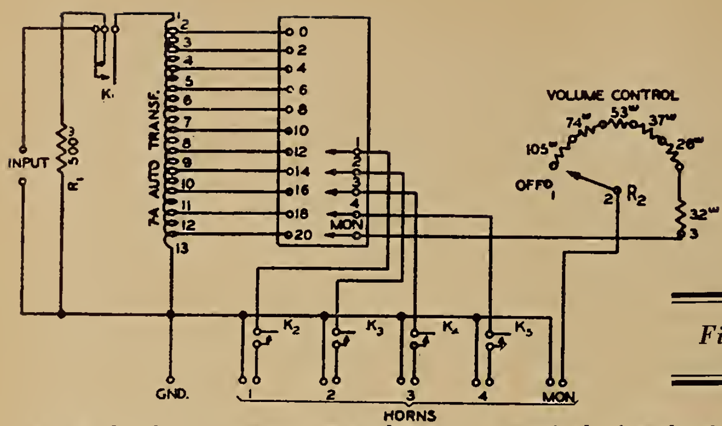


Figure 3

is either the dummy resistor, 500 ohms, or the whole winding of the autotransformer, which is also 500 ohms. This winding constitutes the primary of that transformer, the secondary being that fraction of the same winding which is connected through the tap-switches, as will be traced below, to the speakers. This arrangement represents a standard autotransformer circuit.

It is necessary to note that the impedance of the primary, or the whole winding of 7A, is 500 ohms *only* when an impedance of 15 ohms is connected across the secondary, as can readily be understood by considering the action of any transformer.

Consider the case of a transformer with primary current flowing but with the secondary open-circuited. Very little current will flow in the primary, the impedance of which is high because of the inductive opposition offered by the magnetic field. Now place a high-resistance load across the secondary. Secondary current flows, and this flow creates a secondary field that opposes the primary field, hence lowering the inductive opposition (or impedance) to the flow of primary current, and consequently permitting an increase in that current. Lower the resistance across the secondary and the secondary current increases, reducing still further the impedance of the primary. Hence any transformer with a rated input impedance of so-many ohms possesses that impedance *only* when the rated secondary load is applied.

Assume the correct secondary load to be connected across the autotransformer of Fig. 1, and the primary impedance of that transformer will match the 500-ohm output of the amplifier used with it.

Secondary Circuits of Fig. 1

Beginning at the bottom of the autotransformer, Terminal 13, trace downward to the point at which four wires meet. One of these, as already traced, comes from Input Terminal A of Fig. 1. Another comes upward from the ground connection, picking up Input Terminal C on the way. The fourth runs right across the drawing and is the output common bus. The left-hand output terminal of each of the seven pairs of output terminals, shown at the bottom of the drawing, connects to this bus. Therefore one of each of these seven output pairs runs to the bottom of the autotransformer.

Take output pair number one, the left-hand output pair, and follow its right wire upward to the 406-R key. This key is the on-off switch for the speaker connected to that terminal and is wired to act as a single-pole, single-throw switch. When it is termed "on" the two inner prongs are spread apart, forming parallel contacts to the two outer prongs.

When this 406-R key is thrown to "on," the output circuit may be traced upward to the 11-point tap switch, by means of which the other side of this output circuit may be connected to any one of eleven taps along the autotransformer winding. That portion of the autotransformer which is included between its bottom terminal and the terminal to which this tap switch is set constitutes the secondary winding.

Six similar output arrangements are shown to the right of, and in parallel with, the one just examined. If all tap switches are set to the same point, all outputs are connected in parallel across the same secondary. But if some are set to one point, and some to another, then the autotransformer is given two or more secondaries, each of which delivers a different voltage.

The impedance arrangements involved are indicated in Table A.

This impedance index represents the percentage of total possible output voltage that is available at the tap in question, and also furnishes a convenient method of calculating the correct impedance relationships for different speaker connections. In this calculation the monitor speaker, connected to the extreme right-hand terminals of Fig. 1, is disregarded, since a 50-ohm resistance is wired in series with the monitor speech circuit. That resistance makes the impedance of the monitor line 65 ohms, which is high as compared with other speaker circuits. Consequently, the monitor will draw comparatively little power, and its tap-switch—the extreme right-hand tap-switch in Fig. 1—can be used freely to control the monitor volume as desired without regard to impedance relations.

The impedance of the stage speakers must be matched to the circuits of Fig. 1, and this is done by chosing switch settings that will add up as nearly as possible to an impedance index figure of 1.00. Thus, if there is only a single stage speaker (impedance 15 ohms) its tap-switch is set to terminal "O" for an impedance index of 1.00, a 15-ohm voice coil having been wired across 15 ohms of autotransformer secondary for perfect match.

Again, if there are four stage speakers, the tap-switch setting may be 6-6-6-6, wiring four 15-ohm voice coils in parallel to create an impedance of 3.75 ohms across a transformer impedance of 3.75 ohms, also a perfect match. The impedance index for setting 6 is .25, and four such connections add up on the index to 1.00.

Other adjustments are possible, in which tracing the impedance relationships would be more involved, and calculation is simplified by resort to the index. In the settings given above, the volume from all speakers is the same. The problems of distribution may require different volumes from different

TABLE A

Dial Setting	Transformer Tap No.	Impedance	Impedance Index
0	2	15.00	1.00
2	3	9.45	0.63
4	4	6.00	0.40
6	5	3.75	0.25
8	6	2.40	0.16
10	7	1.50	0.10
12	8	0.90	0.06
14	9	0.60	0.04
16	10	0.45	0.03
18	11	0.30	0.02
20	12	0.15	0.01

speakers. A switch setting of 4-4-10-10 adds up to 1.00 on the index.

In a number of cases, the acoustic requirements of the theatre may make it impossible to secure the ideal index figure, and any index result from .75 to 1.25 is acceptable in practice. If, for example, there are three speakers, the switches may be set at 4-10-4, which adds up to .90 and is entirely satisfactory, only 10% of the amplifier volume being lost through impedance mismatch.

The Circuits of Fig. 3

Fig. 3 is essentially a simplification of Fig. 1. It uses the same autotransformer. The input R-E switch is, however, omitted. If an emergency amplifier is used. it is switched through a systems switching panel. The input switch of Fig. 3 is K-1, a single-pole, double-throw switch that merely cuts the speaker system "off" or "on," substituting the 500-ohm resistor R-1 when speakers are "off." The four speaker switches K-2 to K-5, inclusive, are single-pole single-throw keys. The tap switches of Fig. 1 are omitted entirely.

Speaker connections to the terminal panel are soldered and permanent, being made at the time sound is distributed in the theatre in accordance with the acoustic requirements and with the impedance index previously cited. In Fig. 3, as drawn, these connections are seemingly made to Terminals 12, 14, 16 and 18 (which correspond to the tap-switch settings similarly numbered in Fig. 1), but in practice all four speakers would probably be paralleled to Terminal 6 to meet the requirements of the index. Or, as previously indicated, two might be wired in parallel to Terminal 4, and two more in parallel to Terminal 10.

The arrangements shown in Fig. 3 are intended to suggest a choice, not to represent connections, which if actually made as shown would be entirely incorrect, according to the index, and constitute a serious impedance mismatch.

Since tap-switches are omitted from Fig. 3, a rheostat is included to provide means for modifying monitor volume. The 32-ohm resistor connected in series with this rheostat insures that the impedance of the monitor line never can become low enough, at any rheostat setting, to interfere seriously with the impedance matching arrangements made for the stage speakers.

While Fig. 1 has provision for six stage speakers, Fig. 3 can accommodate only four, and consequently two of the panels of Fig. 3 are used when more than four stage speakers are installed. In such installations there are commonly two output amplifiers in parallel, with a net output impedance of 250 ohms, working into two 500-ohms 209A panels in parallel, or into a net impedance of 250 ohms. The speakers are divided equally between the two panels, and connections to each panel are made in accordance with the index.

Where two output amplifiers in parallel are connected to a single 200A panel, or to a single 209A panel, the impedance index is sometimes used to add up to 1.00 with satisfactory results but better match is secured if, in such cases, the settings are chosen to add the index to 2.00. This doubles the flow of secondary current, and hence has the effect of reducing the primary impedance to closer match with the 250-ohm output of the paralleled amplifiers.

TECHNICAL ASPECTS OF THE RECORDING PROCESS

By R. H. TOWNSEND

This highly interesting story of the recording process, originally presented to the S. M. P. E.[1]*, details some of the early difficulties of introducing sound pictures artistically and commercially, and discloses studio procedure with which every projectionist should be familiar.*—Editor.

BEFORE the advent of sound, motion pictures had attained a high state of development, in the art of pantomime and in extreme flexibility of action. For a full and complete enjoyment of the picture the audience was called upon to exercise but one of its five senses, *i.e.*, that of sight.

One October night in New York City in 1927, however, something happened that projected the entire motion picture industry into a series of artistic, technical and directorial convulsions, and which, in spite of a wide variety of sedatives and palliatives in the form of executive and engineering experimenting, still recur at altogether too frequent intervals. This was the night Warner Brothers' *Jazz Singer* electrified Broadway in more ways than one.

Overnight almost, the whole technical structure underlying the production of motion pictures experienced a tremendous shake-up. Any one who has had any connection with the industry during the past seven years has at least some idea of what has happened. Flimsy outdoor platforms, known as stages, covered with cheap muslin screen were replaced at a cost of millions of dollars with massive concrete structures, the walls of which were thick and solid enough to withstand artillery fire.

Stars whose names had blazed from electric lights upon thousands of marquees all over the world suddenly faded into oblivion because the public was unable to reconcile queer sounding vocal renditions with beautiful profiles, voluptuous curves and manly figures. Somehow it didn't seem quite right to see upon the screen a real "he-man" with a gun in each hand galloping into the scene upon a fiery broncho and then hear him in a thin falsetto voice demand that the villain "unhand that there maiden." It was a real calamity for a producer to be faced with the realization that his glamorous star of the heretofore silent screen, when the story called for a song to her lover in the moonlight, had a vocal range of less than half an octave and most of her few tones just a little bit flat.

Nothing in the line of lighting, photography, action, or beautiful scenery could overcome those handicaps. Something had to be done and out of that something has been developed a recording and re-recording technic that, even in its present state, is truly amazing.

Early Sound Picture Problems

One of the first sound picture problems confronting producers was the disposal of the silent pictures already made and those in production. For the most part, pictures already completed were temporarily held up, and a print sent to a recording laboratory which up to that time had been devoted entirely to the production of phonograph records. A musical score for the entire production was composed and arranged by the laboratory staff personnel together with composers and arrangers employed by the picture producer. Recordings were made of the score and the picture released with a disk record of music accompanying each reel.

Later, as recording equipment became available, certain sequences in pictures were made with sound; dialog and sound effects were recorded at the time the particular scenes were photographed. The remainder of the picture carried a musical score with occasional incidental sound effects, and the entire production was released upon either film or disk. Most of the early productions were made with disk records. The installation of sound equipment in the theatres was meanwhile progressing, and more and more pictures were being made complete

(*Continued on page* 25)

[1]Journal of the S.M.P.E., Vol. XXV (Oct., 1935) No. 4, p. 341.

I. P. Withdraws Approval of Relfector Shields

Recent tests disclose unwarranted and excessive light loss in glass guards previously endorsed

THE January, 1935, issue of INTERNATIONAL PROJECTIONIST (p. 24) carried an unqualified endorsement of the glass shields, known as Mirror Guards and Reflector Shields. I. P. now acquaints the craft with the fact that it has withdrawn this endorsement until further notice.

The original purpose of these shields was to protect the mirror from carbon pits, dirt and dust, the theory behind their use being that it was much less expensive to utilize these thin glass shields for this purpose rather than the mirror itself. The economy of these shields was obvious: after the shield itself had been pitted and begrimed, it could be replaced by a new shield, the comparatively low price of which permitted this procedure.

These glass shields were first tested by the Projection Practice Committee of the S. M. P. E., the endorsement of which was subjected to the bitter fire of optical companies and lamp manufacturers who apparently considered the use of these shields as constituting a very real menace to the sale of mirrors. And so they did.

First Shields Satisfactory

Tests made by the Committee disclosed that the shields delivered everything that was promised for them. They did prevent pitting; they did protect the mirror against dirt and dust; they were economical to use, and most important, their curvature was so close to that of the mirror itself that the light loss occasioned by their use was negligible. In the words of the Committee, "the light loss therefrom was such as could not be detected by the most sensitive meters." So far, so good.

During the ensuing year, however, something happened to change radically the basis upon which was predicated approval of these shields by both the Projection Practice Committee and this publication; and it is precisely on the score of excessive light loss that I. P. now withdraws its approval of this equipment.

Tests conducted recently by I. P. disclose that the light loss occasioned by the use of these shields, far from being the "negligible" quantity cited by the Committee, is now extremely excessive, ranging from 10 to 20 per cent. This is in sharp contrast to the "less than 1%" loss originally reported by both the S. M. P. E. and this publication.

The Committee's findings in this respect were challenged by such distinguished practitioners in the art as Mr. F. H. Richardson, who asserted that there just had to be "a loss of at least 4 per cent for each polished surface of glass through which light passes." Another critic stated: "The best optical glass has a reflection loss at each surface of 4 per cent. The guard provides two surfaces through which light must pass on its way to the mirror; and on its return the light must pass through those surfaces again. Four such surfaces must be considered."

Question of Light Loss

These arguments were demolished by the appended statements culled from the discussion following presentation of the Committee report:

MR. SACHTLEBEN: The light reflected by the light-guard will be 4 per cent at each surface, but because the surfaces of the light-guard are concentric with the surface of the mirror, the light reflected from these surfaces, except for second order reflections and a very slight absorption in the glass itself, will be added to the light from the mirror. This loss of light will be very small.

Reflections do occur, but most of the light so reflected adds to the light coming from the mirror. In view of the theory of application of the guard, the findings of the Projection Practice Committee are perfectly acceptable.

PRESIDENT GOLDSMITH: It may be, of course, that extreme accuracy is not as necessary as we perhaps think. If the auxiliary guards are thin and if their surfaces are reasonably clean, then the major loss of light, of useful light, will result from absorption in the glass, rather than from reflection, and that necessarily will be fairly small in good, clear glasses.

To which Mr. Harry Rubin, Committee Chairman, added that even granting the contention that there was a 4 per cent light loss for each glass surface (which he refused to credit on the basis of his tests) he still would back the combination mirror and guard against any mirror which had been in use for even one week. And so the discussion proceeded.

Its interest in the present efficacy of these mirror guards aroused by reports from the field indicating considerable dissatisfaction, particularly on the score of excessive light loss, and not wishing the unqualified endorsements of both the Committee and itself to stand in the face of poor performance records, I. P. decided to again test the guards. Fortunately the original guards used by the Committee for its tests were available, and all operating conditions could be matched exactly.

I. P.'s findings during these tests were that the present crop of mirror guards now being used in the field are most unsatisfactory, the light loss, as stated previously, ranging from 10 to 20 per cent. Even a light loss of 6 or 8 per cent would be acceptable, in view of other obvious advantages of the guards; but anything over 8 per cent is wholly unacceptable and sufficient reason for the withdrawal of I. P. approval.

The reason for this sudden sharp increase in light loss through use of these guards is not known to I. P., but it hazards a guess that it will be found to lie in the root of all evil. It is recalled that when the mirror guards were introduced, certain companies having a vital interest in maintaining the reflector sales level advanced the objection that the guards, being of the proper curvature, could easily be silvered and thus made into a reflector of good quality.

Deliberate Curve Error

Intensely disturbed by this threat to altered slightly so that, while it would their business, optical companies suggested that the curve of the guard be not result in more than an insignificant light loss when used as a guard (probably not more than 6 per cent at the outside) its use as a silvered reflector would be impossible for all practical purposes. The logic of this reasoning is quite apparent, since the small error introduced into the curve of the guard would be cumulative when, as and if an attempt were made to silver the guard surface.

But something else apparently was cumulative, and that the gradual increase in light loss occasioned through use of these mirror guards. As previously

One For the Book

A delectable contribution to the store of projection humor has been supplied by C. D. Peck, Secretary of L. U. 414, Wichita, Kansas. It goes like this:

A "chief projectionist" of a tank-town theatre circuit succumbed to the blandishments of a local supply dealer and invested in a print of the S. M. P. E. Visual Test Reel. Two weeks later this high priest of projection stalked into the supply store with the fire of battle gleaming in his eye.

"What's eating you?" was the timid question of the dealer.

"Why you so-and-so," bellowed the projection man. "That S. M. P. E. Test Reel was a plain steal. The picture jumps worse with the Test Reel than it does with the regular program!"

stated, a loss of approximately 6 per cent is acceptable; but wholly unacceptable are the figures adduced by I. P.'s recent tests, ranging from 10 to 20 per cent. All other advantages of the mirror guards cannot outweigh the great disadvantage of such a high level of light loss.

And so it is that I. P. records its emphatic disapproval of those mirror guards now being distributed throughout the projection field, no less than it disapproves of those manufacturing and sales tactics which necessitate this announcement.

Some day both manufacturers and distributors of projection equipment will realize the shortsightedness and, now that the craft has an organ of opinion through which they may become acquainted with such matters, the futility of such procedure. I. P. has no intention of using factual presentations such as these to bludgeon recalcitrant manufacturers or distributors into line with its views. It does reserve the right, however, to exercise its proper function of keeping the craft posted on such developments, which procedure cannot fail to ultimately benefit both the craft and the art.

In passing, we commend to the attention of the projection field the oft-demonstrated influence of any honest organ expression over sales of equipment. Which is precisely as it should be.

JAMES J. FINN.

Screen Brightness Symposium Topics Cited by S. M. P. E. Committee

THE standards of the Society contain, at present, a list of nine items under the heading "Recommended Practice." These items, while not so fundamentally important as the dimensional standards, are valuable as suggestions for the guidance of the industry. A recommendation of screen brightness should logically be included therein.

The newly organized Projection Screen Brightness Committee has been given the task of preparing a report upon the basis of which the Society can make such a recommendation. The job is not a new one in the history of motion pictures. It is, indeed, somewhat discouraging to discover that in the past twenty years no less than five previous committees of our own and other societies have worked upon this specific problem. Most of these committees have attacked the problem by attempting to work as groups to gather data on existing conditions in the theatre.

The present Committee feels that it can best serve the Society not by turning itself into a research body to obtain additional data on theatre screen brightness, but rather by stimulating individual authors to prepare reports dealing with the most important phases of the subject. What the Committee proposes is that a symposium of papers shall be presented at a forthcoming meeting of the Society, and that these papers shall be followed by a final report of the Committee which will summarize the whole situation and will make definite recommendations.

The following proposed program of the screen brightness symposium is, of course, only tentative. Additions and changes will, no doubt, seem necessary as the work progresses. It is the hope of the Committee that our selected authors will be able to gather up the loose ends of the existing data and fill in the missing items to such an extent that definite recommendations can be made.

Suggested Symposium Topics

(1) A study of the literature bearing upon the question of screen brightness (covering all known relevant data of physiological optics and suggesting subjects for research necessary for a complete understanding of the problem. This paper should consider the work of Helmholtz, Konig, Trolland, Nutting, Reeves, Feree, and Rand, Luckiesh and Moss).

(2) An analysis of the published results of the theatre and screen illumination measurements (covering the various papers on the subject as, for instance, those of Dennington, Burrows, and the various Committee reports).

(3) An analysis of release print characteristics (a statistical study of the highlight, shadow, and average transmission of scenes of release print quality).

(4) An experiment to determine the screen brightness requirements of the public (a statistical study of the desires of a typical audience—the matter of individual taste, the influence of subtended visual angle, the influence of auditorium illumination).

(5) A note on laboratory screening room measurements (an account of the data obtained in release-print laboratories, with a discussion of the relation between theatre and laboratory screen brightness).

(6) Methods of measuring screen brightness (a paper to guide the Committee in its forthcoming recommendation of standard practice of measurement).

(7) Projector characteristics, screen characteristics, and obtainable brightness (an attempt to combine the existing data on screen reflection and source output in the form of tables and curves usable by the theatre manager).

(8) A report by the Committee (final recommendations of (*a*) screen brightness limits, (*b*) method and instruments of measurement, (*c*) best brightness as a function of screen size (visual angle) and auditorium illumination).

S. M. P. E. Fall Convention at Washington, Oct. 21-24

THE Fall, 1935, Convention of the Society of Motion Picture Engineers will be held in Washington, D. C., October 21-24, inclusive. Headquarters will be at the Wardman Park Hotel, with rates as follows:

One person, room and bath	$3.00
Two persons, double room	5.00
Two persons, twin beds	5.00
Connecting parlors	5.00

An attractive program of technical papers and presentations is being arranged by the Papers Committee. Sessions will be held in the *Little Theatre* of the Hotel, off the west lobby, as follows: Monday to Thursday mornings, inclusive; and Monday, Tuesday, and Thursday afternoons.

Exhibitions of newly released motion picture features and short subjects will be held in the *Little Theatre* on Monday and Tuesday evenings. Passes to various motion picture theatres in Washington will be available to the members.

Apparatus Exhibit

An exhibit of newly developed motion picture apparatus will be held in the east lobby of the Hotel, to which all manufacturers of equipment are invited to contribute. The apparatus to be exhibited must either be new or contain new features of interest from a technical point of view. Information concerning the exhibit and reservations for space should be made in writing to the Chairman of the Exhibits Committee, Mr. O. F. Neu, in care of the Society, Hotel Pennsylvania, New York. No charge will be made for space.

The usual luncheon will be held at noon on October 21st. The semi-annual banquet will be held on Wednesday. October 23rd at 7:30 P.M. Addresses will be delivered by eminent members of the industry, followed by dancing and entertainment. The presentation of the scroll of honorary membership to Thomas Armat, of Washington, D. C., awarded last May at Hollywood, will be made, and, in addition, the recipients of the Journal Award and the Progress Medal of the Society will be announced and the presentations made.

The Hotel management is arranging for golfing privileges for S. M. P. E. delegates at several courses in the neighborhood. Regulation tennis courts are located upon the Hotel property, and riding stables are within a short distance. Trips may be arranged to the many points of interest in and about Washington.

Model Room Layout By the S.M.P.E. Projection Committee

The accompanying report[1] of the Projection Practice Committee, a revision of and addition to the 1931 report of the same group, is intended to apply to all new construction or remodelling of projection rooms. It is another creditable job by a group that has done much for the art and the craft.

THE following recommendations for projection room planning have been formulated after an exhaustive study by the Committee and are submitted for adoption as standards. The Committee urgently recommends their acceptance by all architects and builders in constructing and remodeling projection rooms so that a greater uniformity of projection room construction will exist in the future.

In following these recommendations the proper authorities should in all cases be consulted for possible deviations therefrom. Any fire protection requirements specified herein are in accordance with the regulations of the National Board of Fire Underwriters. However, these requirements are neither complete nor in detail, and it is the plan of the Committee to work with the Underwriters in the near future in the preparation of a comprehensive set of recommendations for adoption as standard regulations by the industry.

General.—Three layouts are presented which were planned with careful regard for flexibility, simplicity of construction and ease of operation. (Ed.'s Note: Only one layout, that for standard-size theatre projection rooms, (Fig. 2), is published herein. Prints of the other layouts, for small- and large-size rooms, may be had upon request to either I. P. or the S.M.P.E.)

The particular plan to be followed should be selected according to the size of the theatre and the manner of operating it. The key to the symbols used on the plan is shown in Fig. 1.

The projection room shall be fireproof and sound proof, and all walls exposed to the theatre shall be of tile, brick, gypsum or other approved fire-resisting material. It shall have a minimum height of 10 feet and a maximum of 12 feet. The minimum depth shall be 12 feet. The length of the projection room shall be governed by the quantity and the kind of equipment, as shown in the plans and in accordance with local requirements. Consideration should always be given to probable future needs.

The Committee recommends that the projection room be located outside the fire-wall of the theatre, and that it be so situated that the projection angle shall not exceed 15 degrees.

Floor.—The floor of the projection room shall be sufficiently strong and solid for the load it is to bear, and shall be constructed in accordance with local building regulations. A generous factor of safety should be allowed.

A type of floor construction that is recommended consists of (1) a reinforced concrete floor-slab not less than 4 inches thick; (2) a tamped cinder fill above the floor-slab not less than 2 inches thick; and (3) a trowelled cement finish above the cinder fill not less than 2 inches thick.

Ceiling.—The ceiling shall be of plaster or cement suspended on metal laths or other suitable material.

Walls.—The finished walls of the projection room shall be not less than 6 inches thick, including an inside and an outside layer of plaster at least ¾ inch thick. In all cases, the inside surface of the front wall shall be smooth and without structural projections.

Acoustic Treatment.—The inside walls and ceiling of the projection room shall be finished with an acoustic plaster or other sound-absorbing material approved by the proper authorities.

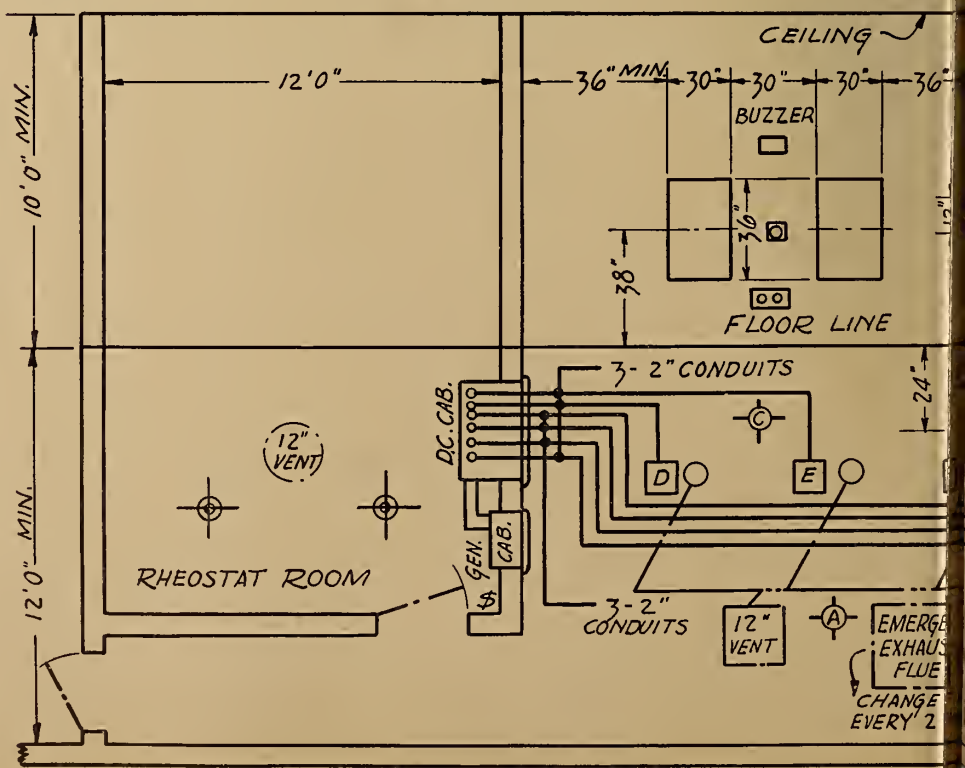
The finished projector ports shall be 10 inches wide and 12 inches high (Fig. 3). The bottom of the opening shall be splayed.

Tables I and II apply to certain well known makes of projectors. Table I gives the distance from the front wall to the center of the conduit outlets in the floor for the projectors. Table II gives the distance from the floor to the center line of the projector ports for different angles of projection.

In preparing this report, the Committee encountered considerable difficulty in forming suitable recommendations for the location of the projector ports. This was due to the non-uniform design of the various makes of projectors.

The Committee recommends the use of means other than glass in projector ports to prevent transmission of noise from the

FIGURE 2. Layout for standard-size projection room. All conduits concealed



[1]Journal of the S.M.P.E., Vol. XXV (Oct., 1935) No. 4, p. 341.

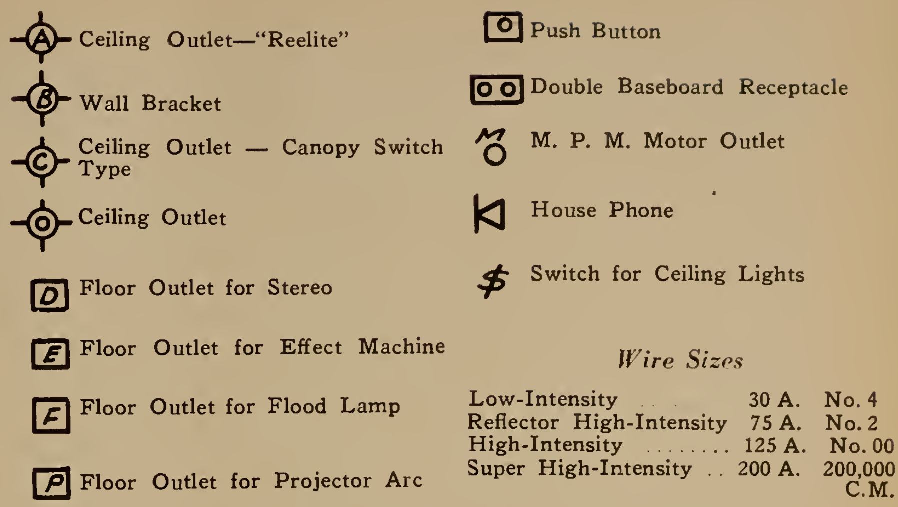
projection room to the auditorium, such as reducing the free aperture of the port to the minimum essential for projection.

Observation Ports.—The free aperture of the observation ports shall be 12 inches wide and 14 inches high, and the distance from the floor to the center line of the openings shall be in accordance with Table V. The bottom of the port shall be splayed.

The observation ports shall be fitted with a good grade of plate glass set at an angle and provided with a rubber frame between the glass and the sides of the port hole in order to reduce the transmission of sound from the projection room into the auditorium. The glass shall be hinged at the centers of the side edges so that by swinging it to a horizontal position, both sides can be cleaned from the projection room.

Other Ports.—All other ports, such as those intended for effect projectors, dissolving stereopticons, or single spotlamps, shall be 30 inches wide and 36 inches high. The distance from the floor to the center line of the ports shall be 38 inches. The minimum spacing allowed between these ports shall be shown upon the plans. The bottom of the ports shall be splayed in accord with usual practice. The placing of these ports to the right or the left of the projectors shall be optional and according to conditions.

Floor Covering.—Where local regulations permit, the floor of the projection room should be covered with a good grade of fireproof material; otherwise, the cement should be painted or filled. The floor covering should be laid before the equipment is installed. The floors of rooms adjacent to the projection room should be painted with a good grade of paint for concrete.



Wire Sizes

Low-Intensity	30 A.	No. 4
Reflector High-Intensity	75 A.	No. 2
High-Intensity	125 A.	No. 00
Super High-Intensity	200 A.	200,000 C.M.

FIGURE 1. Key to symbols used in room diagram

Green Paint Recommended

Painting.—The color of the projection room walls and doors shall be olive green to the height of the door lines. Acoustic material should either be painted in accordance with the instructions of the manufacturer of the material, or materials of the specified colors should be chosen. The walls above the door line and the ceiling shall be a buff color. All iron work of projection ports shall be covered with at least two coats of flat black paint. All other rooms shall be painted buff.

Conduits.—(*a*) Conduits shall in all cases be concealed, and all boxes shall be of the flush-mounting type. (*b*) The size of conduits for projection arcs shall be in accordance with the wire sizes indicated in Fig. 1, and in conformance with the regulations of the proper authorities. These sizes anticipate the need for increased capacity, and should be adhered to in order to provide space for pulling in larger wires as needed. (*c*) Conduit for sound equipment shall conform to the type of sound equipment to be installed. The manufacturers of such equipment should be consulted with regard to the proper layout of the sound system before proceeding with the installation.

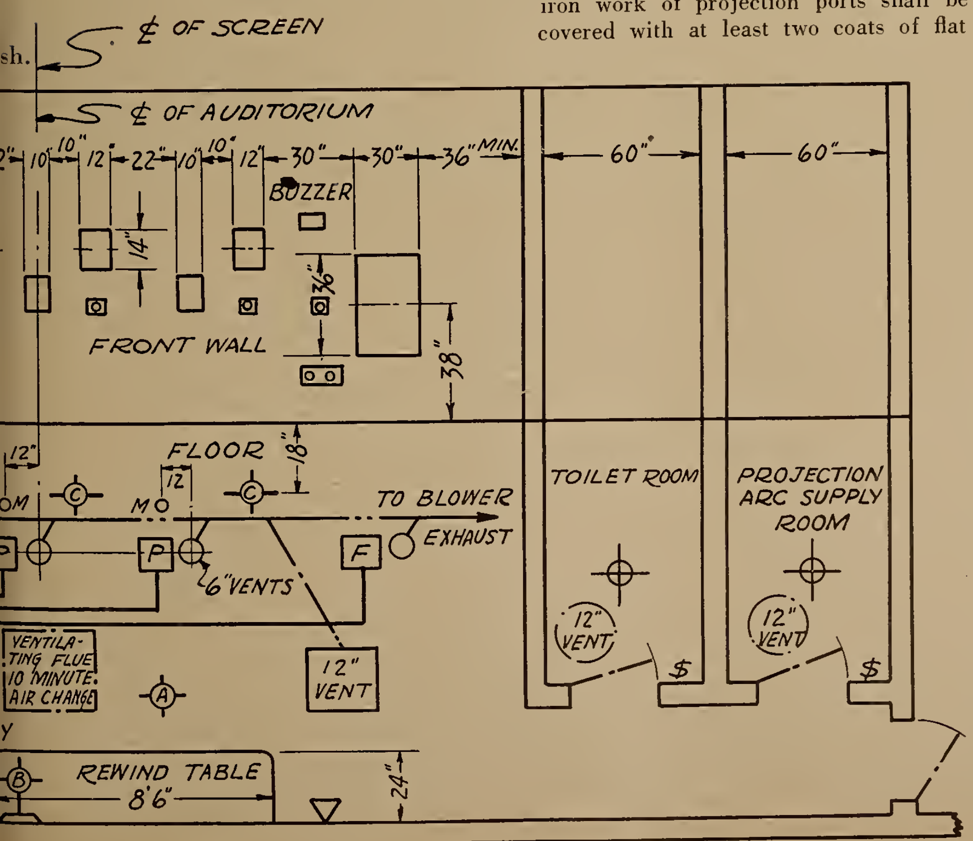
Lighting, Heating and Ventilation

Lighting.—An individual approved ceiling fixture with canopy switch shall be installed for each piece of equipment, and shall be placed in line parallel to the front wall at a distance not less than 18 inches nor more than 24 inches from the front wall. The outlet connected to the emergency lighting system shall be located in the ceiling midway between the extreme ends of the projection room and 4 feet from the back wall. Small projection rooms shall be equipped with one approved "reelite," and large projection rooms with two such lights conveniently located.

Heating.—Proper provision shall be made for heating the projection room. The same facilities used for heating the theatre should be extended to the projection room.

Ventilation.—An exhaust system of ample capacity shall be provided for the projection room and other adjacent rooms used in connection with projection equipment. All arcs of whatever description shall be connected into the ducts of a separate exhaust system containing a blower type of exhaust fan.

There shall also be a separate opening



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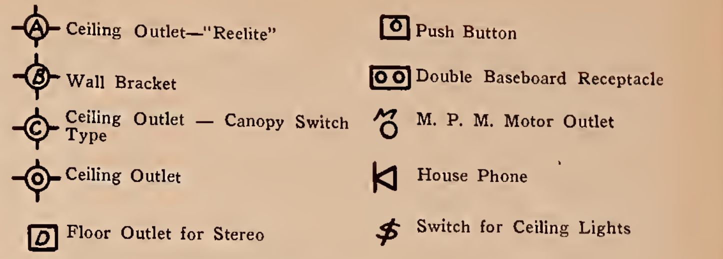

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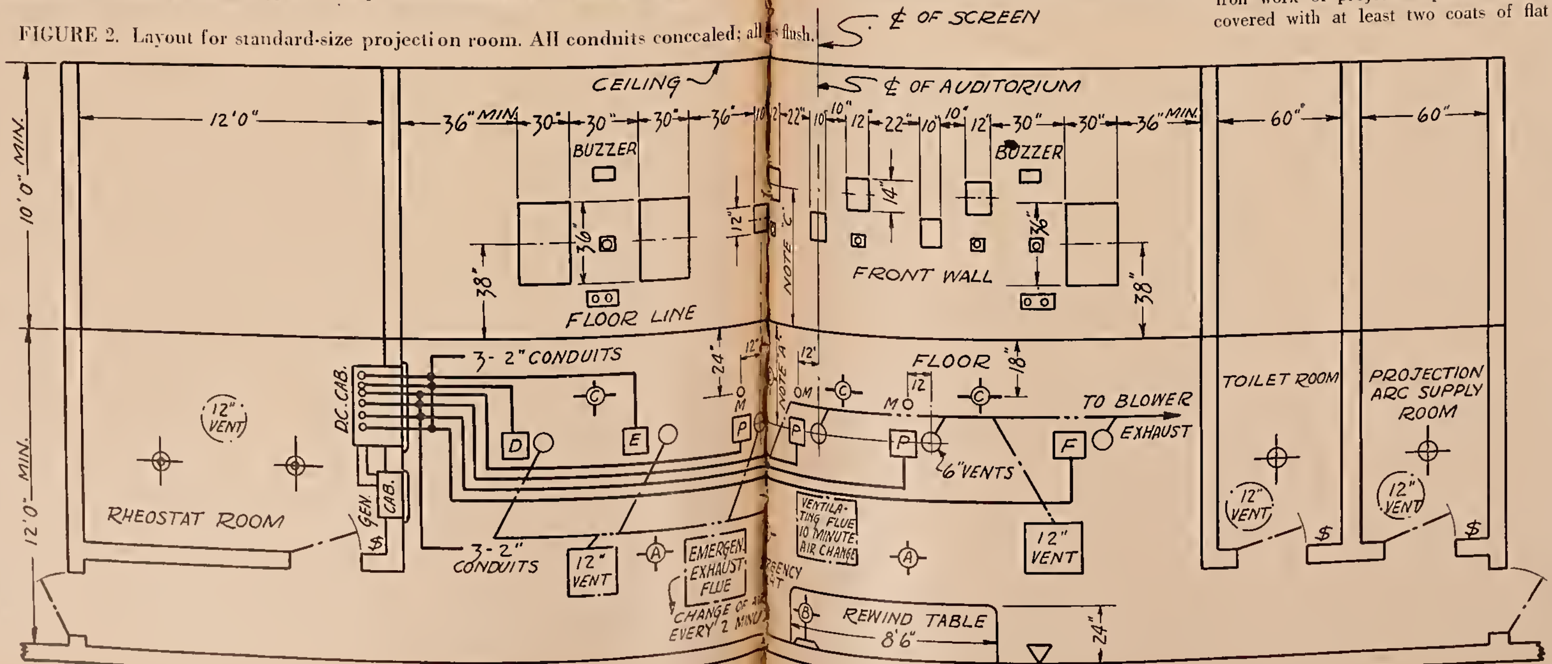
FIGURE 1. Key to symbols used in room diagram

FIGURE 2. Layout for standard-size projection room. All conduits concealed; all boxes flush.



[1] Journal of the S.M.P.E., Vol. XXV (Oct., 1935) No. 4, p. 341

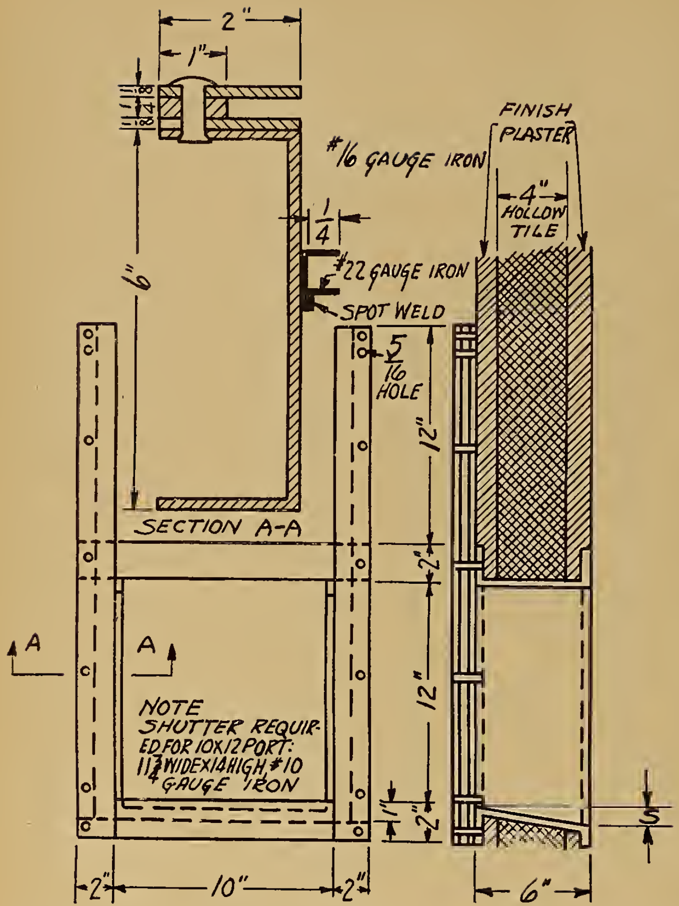


FIGURE 3

Standard projection room porthole construction

or vent flue in the main projection room leading directly to the nearest outside air. Such flues shall be at least 78 square inches in cross-section and constructed of incombustible materials. When the projection room is in use, a current of air shall be maintained through the room to the outside air at a minimum rate of 50 cubic feet a minute, and sufficient to furnish a complete change of air in 10 minutes. In cases where the theatre is air-conditioned, the projection room shall be connected into the main duct of this particular system.

Additional Rooms.—A separate room shall be provided solely for the rheostat equipment. This room shall be provided with ventilating means as previously set forth. An additional and separate room, properly ventilated, shall be provided for the projection arc supply equipment. Where local regulations require, a properly ventilated room should be provided for rewinding.

Toilet and Washrooms.—Hot and cold water and other toilet facilities shall be installed, and located convenient to the projection room. Suitable space shall also be provided for clothes lockers.

Projection Room Equipment

Projectors and Spacing.—Where two projectors are used, they shall be equally spaced upon either side of the center line of the auditorium. When three projectors are used, the center projector shall be placed upon the center line of the auditorium. The distance between projectors shall be 4½ feet, measured between lens centers, for projection distances of less than 100 feet. For projection distances less than 100 feet, the spacing shall be 4 feet.

Arc Supply and Location.—In those cases where the projection arc supply consists of machinery that generates acoustical hum or mechanical vibration, the use of acoustical or mechanical insulation will be required. Rotating machinery used for projection arc supply shall be located as remotely as possible from the auditorium and the projection room. Arc supplies other than rotating equipment may be located in the room adjacent to the projection room, but precautions should be taken to place this equipment at least 4 feet distant from the sound equipment.

Meters.—Suitable meters shall be provided for properly checking the performance of the projection room equipment, with as good visibility as required, and located in suitable positions.

Power Supply to Equipment.—Where line-voltage variations are greater than ±3 per cent, the power company should be requested to rectify the condition. In those cases where it is impossible to maintain a steady line supply into the theatre, either manually-controlled or automatic regulators should be installed.

Film Storage.—Approved film storage cabinets having a capacity sufficient to

(*Continued on page* 23)

TABLE I

Distance from Front Wall to Center of Projector Conduit Outlet

Proj. Angle (Degrees)	Simplex R.C.A. Type *R* Stand	Simplex West. Elect. Type *R* Stand	Motiograph	Simplex Acme	Simplex R.C.A. *L* and *M* Base	Simplex West. Elec. *L* and *M* Base
—6	44½	45	24	26½	30	33
—4	45	46	25½	26½	30	33
—2	46	47	27	27	30	33
0	47	48	28½	27½	30	33
2	48	49	30	28	30	33
4	48½	49½	31½	28½	30	33
6	49	50	33	28½	30	33
8	50	51	34	28½	30	33
10	51	52	35½	28½	30	33
12	52	53	37	29	30	33
14	53	54	38	29	30	33
16	54	55	39½	29	30	33
18	54	55½	40½	29	30	33
20	55	56	42	29	30	33
22	56	57	43	29	30	33
24	57	58	44	28½	30	33
26	58	59	44½	28½	30	33

TABLE II

Height from Floor to Center Line of Projection Port

Proj. Angle (Degrees)	Simplex R.C.A. Type *R* Stand	Simplex West. Elect. Type *R* Stand	Motiograph	Simplex Acme	Simplex R.C.A. *L* and *M* Base	Simplex West. Elec. *L* and *M* Base
—6	51½	51½	52	51	51	51
—4	50	50	50	50	50	50
—2	49½	49½	49	49	49	49
0	48	48	48	48	48	48
2	47½	47½	47	47	47	47
4	47	47	46	47	46	46
6	45½	45½	45	45	45	44½
8	44	44	44	44	44	43½
10	42	42	42	43	43	42½
12	40	40	41½	52½	42	41
14	39	39	40	41½	41	40
16	37½	37½	38½	40½	40	39
18	35½	35½	37	39½	38½	38
20	34	34	35½	38½	37½	37
22	33	33	33½	37½	36½	35½
24	32	32	31	37	35½	34½
26	31½	31	30	36	34	33½

Double-Reel Progress Stalled By Exchanges and Legislative Items

FURTHER progress along the trail leading toward adoption of a double-reel standard for the industry was made during the month when Gordon S. Mitchell of the Academy, now in the East, with the assistance of Arthur Dickenson, of the Hays office, met with representatives of major distributing companies, members of the Projection Practice Committee of the S. M. P. E. and other interested parties in an effort to iron out the differences existing between the groups.

Although the major share of attention was given to the attitude of the Unions in various localities toward the double-reel standard, it early became apparent that several of the distributing companies have yet to be sold on the proposition.

No outspoken objection by distributors was forthcoming only because of the desire of Eastern exchange officials to avoid seeming conflict with their West Coast colleagues who had already approved of the longer reel; but there was evident behind the scenes sufficient muttering and maneuvering to indicate strong distributor opposition to the plan.

Passing the Buck

Frankly stated, it appeared to I. P. that certain distributors, while not anxious to openly oppose or impede the double-reel program, would like to pass the buck and be able to charge projectionists with having prevented adoption of a new standard.

Distributor opponents of the longer reel first tried to sell the idea that a large majority of theatres were not equipped to handle the larger reel, which stand was vigorously resisted by projection representatives who brought out that more than 98 per cent of American theatres now operating are equipped with large magazines. Assurances were forthcoming from Mr. Mitchell that the diameter of the proposed large reel would be 15 instead of 15½ inches, as originally proposed.

Still not satisfied, the distributors then suggested that a questionnaire be sent out all over the country in order to prove conclusively the projectionist contention as to large magazine equipment. The intent of this resolution obviously being to stall the project for the weeks required to properly do the job, the meeting voted it down. The foreign situation, the question of disc releases and other relatively unimportant questions were in turn introduced, apparently for no reason other than to delay matters.

The meeting developed the fact that certain large studios have as yet extended only verbal support to the project, and this lent impetus to distributor opposition. Formal approval of all studios was promised for the near future by Mr. Mitchell.

Estimated Savings Questioned

The savings possible through adoption of the double-reel standard were revealed to be much less than had been generally anticipated. Total annual savings to the nine major producers was estimated at the meeting to be $225,000, as contrasted with the original estimate of $1,000,000. The lower estimate gave rise to serious consideration as to whether the savings involved would justify the expense and bother involved in introducing a new standard. Against the total savings must be assessed the cost of replacement equipment (reels, cases, rewinds, etc.); the cost of altering exchange racks, and a possible increase in inspection labor costs.

Exchange alterations would cost considerably more than the $10 per exchange figure originally estimated, asserted several exchangemen. Universal was particularly outspoken in its opposition to the new reel standard, its stand being that an experiment along this line made several years ago had proven conclusively that the savings were more imaginary than real.

Boston L. U. 182 Wars on Double Reel

Negotiations are in progress, as these lines are written, between Gordon S. Mitchell, of the Academy, and Boston L. U. 182 officials relative to the as yet unalterable decision of the latter to insist upon maintenance of the single-reel legislation, given force by a $50 fine, adopted by the Union.

Boston is fighting practically a lone-wolf battle against the double-reel standard, and President Thad Barrows of L. 182 has been most outspoken in opposition thereto. Barrows holds that, whatever promises may be forthcoming from double-reel proponents, the plan cannot fail to ultimately figure importantly in consideration of projection room manpower.

Conflicting opinions as to the exact amount of footage to be saved through use of the double reel abounded, ranging all the way from 76 feet down to 10 feet per feature, representative of the extreme viewpoints. I. P.'s own estimate is that at least 56 feet of film per release would be saved through use of the larger reel, and considerably more if advantage were taken of other existing opportunities to save footage.

The meeting finally agreed that it was so much lost effort and time to consider the technical aspects of the situation before some satisfactory solution was found to the problem of Union opposition to the larger reel. Communications from various sections of the country were read indicating rather widespread acceptance of the proposed reel. Proponents of the double reel now find themselves in the position of having to oppose their own recommendations of 1923 and thereafter, when a strenuous campaign to effect nationwide observance of the single-reel standard was waged, and at which time most of the existing municipal, state and Local Union single-reel legislation was approved.

In Indiana, for example, the State has decreed that all film must be stored and projected in single-reel lengths. Chicago, Cleveland, Omaha, Los Angeles, New York and Boston, to mention only a few cities, have adopted single-reel legislation, with Boston being most insistent upon adhering thereto. Some 23 items in the N. Y. City code relating to motion picture film would have to be changed to afford clear sailing for the double reel.

It is understood, however, that assurances have been forthcoming from all territories, save Boston, that no difficulty will be experienced in effecting legislative changes favorable to the larger reel. No data is available indicating the extent of unanimity on this point, although Boston's answer to date is a definite and emphatic "No."

Technical Aspects

Relative to the purely technical aspects of the double reel, there have been no developments in the interim to occasion any change in the opinion expressed in these columns last month. The absolute minimum footage should be 1750 feet, and not the 1700-foot length proposed by the Academy, because many de luxe

theatres have magazines capable of accommodating about 3440 feet of film.

Likewise, extreme care should be exercised in the "direct cut" mentioned in the Academy editorial specifications, care being taken to insure that no cut is made within 2 or 3 feet of significant action or sound. Some trouble from this end is anticipated, because it will be the exchange's job to join and mount the 1000-foot lengths into double reels.

The question of efficient exchange work in including run-down and run-out film, in addition to the conventional S. R. P. marks, is also deserving of close consideration by the Academy. Assuming an unsatisfactory outcome of the negotiations now in progress to change the minds of double-reel opponents, the exchanges would be faced with much additional work that would require great care in execution. As previously stated herein, the record of the exchanges with this work to date is anything but complimentary to them.

Nothing definite has been adduced meanwhile with respect to the all-important matter of quality reels and shipping cans. Reports reaching I. P. indicate acceptance by Academy and exchange officials of extremely low-price equipment, forecasting not a little future trouble. The theory that double-reel accessories should cost only twice as much as single-reel equipment is fallacious, because it is self-evident that existing reels and shipping cans leave much to be desired in the way of quality.

Short reels offer no projection problem, it is generally agreed, and will continue to be shipped on single reels. The joining of shorts to features will occasion no serious trouble.

Sentiment favorable to a preliminary test period for any standard finally evolved, on all fronts (editorial, exchange, shipping and projection) continues to grow, the contention being that one or two months of tests under actual operating conditions would supply more useful data than a year of conferences.—J. J. F.

What's New IN THE SUPPLY FIELD?

RCA Photophone service contracts are more than double what they were this time last year, according to an announcement made to more than 100 sales and service representatives who participated in a three-day session at the RCA plant in Camden recently.

The gathering also heard detailed statements relating to RCA's entry into the Sonotone hard-of-hearing and Trans-Lux rear projection fields, both units having been added recently to the RCA line, the former being sold and the latter leased. The new RCA push-pull recording was explained and demonstrated.

NEW BRUSH MICROPHONE

A new unidirectional microphone that requires no button current or polarizing voltage is announced by Brush Development Co., Cleveland, Ohio. Known as Model UD-3, this mike has a wide sound field and is sensitive to sound originating over an entire 180°. It is dead at the back, thus being ideally suited for all auditorium work, and is not susceptible to feed-back, audience noise, reflection, camera clicking, etc.

This UD-3 mike is of light weight and small size, although its rugged construction renders it impervious to effects of moisture and mechanical shock.

SUPREME ALL-PURPOSE TESTER

A new all-purpose theatre sound reproducing test set is announced by the Supreme Instruments Corp. of Greenwood, Miss. The manufacturer unqualifiedly recommends this device to projectionists as satisfactory in every respect for all manner of testing of both sound-film reproducing and public address equipments.

The various reading ranges and other pertinent data are set forth in detail elsewhere in this issue. Any and all information relating to sound system testing, and prices of the various test outfits, will gladly be supplied by the manufacturer.

This new all-purpose tester is of a type recommended by INTERNATIONAL PROJECTIONIST to projectionists for use on sound-film reproducing systems of whatever type.

FOREST L-I RECTIFIER

A new bulb-type rectifier for use with low-intensity arc lamps is announced by the Forest Mfg. Corp., Belleville, N. J., which unqualifiedly guarantees the satisfactory performance of this unit. Known as Rectifier Type LD-30, this rectifier is rated at 30 amps, 50 to 55 volts D. C., and will supply current for one lamp. It operates from 110- or 220 volts, 60-cycle, single-phase circuit.

Among the advantages cited by the manufacturer for this rectifier, which uses two bulbs, are: low initial cost yet complete reliability, low operating cost, and no flash-back, asserted to be an exclusive Forest patented feature. Complete details, including price, from the maker.

GOLDE FILM REWINDERS

Hand rewinders developed expressly for use with the impending double reels are announced as ready for immediate shipment by Golde Manufacturing Co., Chicago. Suitable for either projectionists or film inspectors, these rewinders have what is termed a "dual ratio," that is, either 2¾ to 1 or 4¼ to 1. Two sets of gears are employed in the drive head with a novel selective crank. The crank handle may be pulled out while turning for one speed, and then as easily let go for return to low speed.

Folders describing this complete line are available from the maker.

Metal *vs.* Nitrocellulose Film

SAMPLES of metal film have been submitted to INTERNATIONAL PROJECTIONIST with a request for an estimate of its worth for practical projection purposes as compared with the present film stock. Metal film is not new, of course, several variations of such bases having been publicized at various times during the past fifteen years.

Sponsors of metal film naturally emphasize its safety features. Admittedly, such film does minimize the danger of fire, but it certainly cannot be seriously considered as a substitute for nitrocellulose film unless it permits the maintenance of screen values and at the same time does not offer too many projection difficulties. That metal film still is a dream as far as the motion picture field is concerned is established by the appended laboratory report:

"Relative to the sample of metal film submitted recently, we wish to make the following comments:

"(1) The loss of light during projection would be almost prohibitive and, to make a rough guess, under any given conditions, the screen intensity would be only about 1/50 that existing when projecting by transmitted light with the usual film.

"(2) Should metal film buckle, it remains so more or less permanently.

"(3) The edges of the perforations have no resiliency, thus are much more readily distorted by sprocket teeth than is nitrocellulose film.

"(4) It is doubtful whether the degree of adhesion of the emulsion to the film would be satisfactory.

"(5) It would appear to be extremely difficult to splice the film. The manufacturers have not suggested any method.

"(6) With highly alkaline developers, the aluminum probably would be attacked, and, also, prolonged fixation in a fairly acid fixing bath containing silver salts would cause the deposition of silver which would tend to impair the high reflecting power of the aluminum surface."

News of the Month

Brief mention of men and events associated with the motion picture industry of particular interest to projectionists is published here.

LOCAL 306 has ironed out its wage scale differences with the 64 Loew and 42 RKO theares in N. Y. City. Union took a 12% cut to $1.86 per hour per man, two men to a shift, from the former scale of $2.12 an hour. Present cut should be added to previous slash of 10%, which was promised but never returned by the circuits.

Net savings to both circuits through this latest cut will be $200,000 annually, exclusive of overtime, with Loew getting major portion, or $128,000. Circuits originally demanded a 41% cut. Other independent N. Y. circuits not settled yet, nor are the de luxe Broadway houses now paying $2.55 per hour per man, yet in line.

Complete "settlement" of N. Y. City projection troubles is expected shortly—that is, if Local 306 will admit to membership the other two city "Unions," namely Empire and Allied. N. Y. exhibitors. who formed both organizations and supported them financially, warmly favor this amalgamation—provided the one large remaining Union would sign a ten-year contract at a low scale, with increases or decreases to be "arbitrated" every two years on the basis of then prevailing "costs of living."

Should L. 306 accept such bait, its membership would swell to 2.500. As repeatedly pointed out in these columns. amalgamation would fall far short of settling the N. Y. City problem. The total number of projection jobs in N. Y. City, provided all present two-men shifts are maintained, is 1800 to 2000. After amalgamation, L. 306 would be faced with a permanent unemployment list of some 500 men. since weekly hours of work cannot possibly be cut below the 30-hour mark in effect.

The net result would he that either the entire membership would be dropped to a starvation wage level through greatly decreased weekly hours, or the 500 permanent unemployed would tear the organization to shreds. Or, those members working could permanently support the 500 unemployed on a dole.

Merger Not The Answer

All this is quite apart from the fact that even after a merger of L. 306. Empire and Allied, there still would remain outside the combine about 4000 licensed projectionists. The question arises: what would this group of men be doing while the enlarged L. 306 was receiving sweet promises from the exhibitor combine that it would use L. 306 members exclusively? The answer is that they would be engaging in guerilla warfare against the hig Union and accepting jobs for pearut wages. Not forgetting the highly important question as to whether the exhibitor combine could control its individual members. Its record to date is a record of the good old double-cross.

And so it is that there is scant hope for any real settlement of the N. Y. City situation, merger or not, and exhibitor association contract or not. With more than 6000 licenses already issued, more are being handed out every day. Anybody can get a license in N. Y. City, if he has the price and knows his way about.

INTERNATIONAL PROJECTIONIST has long advocated the only sensible means for a real settlement of the N. Y. City situation, and that is by a reexamination ot every projectionist in the city. Projection is the worst in the world, of course, solely because one needs to know nothing in order to obtain a license. I. P. is firmly convinced that a reexamination of the more than 6000 licensees now floating around N. Y., with an ordinary group of questions such as are posed anywhere else, would result in the failure of more than 5000 men, including about 800 of the present 1800 membership of L. 306.

Reexamination Only Remedy

It is common knowledge in N. Y., and has been published in the press, that in previous N. Y. City administrations one needed only the fee, a picture of himself. and a note to the "right party" in order to obtain a license. I. P. hazards the guess that 5000 "projectionists" in N. Y. City today couldn't distinguish an arc lamp from a vacuum tube. More than 5000 can't operate a spot, in fact never saw one. Such is N. Y. City "projection."

A recent convert to I. P.'s advocacy of reexamination is the N. Y. *World-Telegram*, which from the time of Sam Kaplan has manifested a keen interest in L. 306 affairs. This newspaper has already published its first editorial blast favoring restriction of licenses.

A hint as to what the future holds in store for one large Union, the result of a merger of the three existing groups. was given when the Astor Theatre (Broadway) unceremoniously tossed out L. 306 members and, despite the latter's present "working agreement" with the other two "Unions", quickly obtained needed operators at a scale 75% under that of L. 306. So much for the sweetness and light that would follow any merger of unions. Licenses are licenses, and one can't laugh off 6000 of them.

'While You Wait'

The tip-off on the license "racket" existing in N. Y. City today is the numerous sandwich-men (carrying boards front and back) who unceasingly plod back and forth in front of the N. Y. City License Bureau. The signs read:

"Photographs while you wait for chauffers (taxi drivers); passports, motion picture operators . . ."

Business is that good in the "operator" line.

Buffalo L. U. Receivership

Unable to meet a judgment of $12,000 obtained by an expelled member. Buffalo projectionists' L. U. 233 is now under the control of a receiver appointed hy the courts. Court examination of the Union's hooks revealed assets of $2,100, representing sums owed the organization by its 120 members.

Progressivism in Nebraska

The up-and-coming state of Nebraska recently passed anti-picketing legislation. The Empress Theatre at Grand Island requested a wage cut and was refused. The Union put pickets in front of the house. Result: 4 pickets were arrested charged with loitering and interference with the theatre's business. and each was fined $10. This in the year 1935.

Burly Girls Win Raise

N. Y. City burlesque girls have just won a strike which had all the burly houses in darkness for several days. New weekly scale is $22.50 in N. Y. and $25 on the road. Unconfirmed reports had it that certain members of L. 306 were seeking membership in the girls' organization.

St. Louis Auxiliary

Adjustment of the difficult Negro operator situation in St. Louis was accomplished by the formation of an auxiliary unit to L. U. 143 into which were inducted 23 Negroes who will man the colored theatres in that city.

Lumiere "Stereo" Production

Louis Lumiere has completed production of his first "three dimensional" feature picture at his Paris, France, laboratory. Picture is reported to have heen taken with a "two-lensed" stereoscopic camera, whatever that is. Lumiere process, described in the April, 1935, issue of this publication, requires the use of analyzers by the audience.

Cleveland Scale Increase

Projectionists' Local 160, Cleveland, has won a 7½ increase from the Exhibitors Association, under the terms of a two-year contract signed recently. L.

You May Be Next

DEATH and property damage totals resulting from projection room fires are twice as large as for the same period last year. Why? Worn equipment, insufficient manpower and poor prints on one side of the ledger; and on the other side that product of reasoning that "It can't happen to me." But it does somewhere in the U. S. everyday. You may be next.

160 is probably the only Union in America that retains absolute complete control of all servicing operations, whether sound or visual projection equipment.

I.A. Resumes I.B.E.W. Fight

Demanding that the I. B. E. W. pact with the studios be declared illegal, Local 695 (sound men) of the I. A. has filed a petition with the National Labor Relations Board to force recognition under the Wagner Bill enacted by the last Congress. Harold Smith, business representative of Local 695 bases his appeal on the claim that 90 per cent of studio sound men are I. A. members, thus bringing the matter within the terms of the Wagner Bill which provides for majority representation.

Local 40 of the I. B. E. W., which obtained the sound work when the I. A. broke with the studios two years ago, branded Smith's majority claim as ridiculous. Some studio workers, it is known, carry cards in both organizations for maximum protection in the event of trouble.

A. T. & T. Inquiry Opens

The American Telephone & Telegraph Co., of whch Erpi is a subsidiary, will come in for a major portion of attention from the House Patents Committee now in session in New York City to investigate the effect on public welfare of patent pooling in restraint of trade. Among the first witnesses to be called were John Otterson, former Erpi head and now president of Paramount; Will H. Hays, president of the M.P.P.D.A., and Adolph Zukor, former Paramount president.

Film people will have no difficulty understanding Chairman Sirovich's statement that:

"It is significant that on the eve of the hearing, A. T. & T. modified its policy by allowing newspapers to use their own equipment in transmitting telephoto pictures. The lifting of the exorbitant tax exacted in the transmission of telephoto pictures would be a great victory for newspapers. For example, instead of a newspaper paying $1,000 in charges for transmitting pictures from Florida to a newspaper in New York, if the tax were lifted, it would only cost the price of a long-distance telephone call."

Meanwhile, in Washington, Commissioner Walker of the Federal Communications Commission announced that he would begin hearings on the structure of A. T. & T. before Congress next convenes in January. *Film Daily* quotes Walker as stating that the hearings very likely would include Erpi and movie interests "either directly or indirectly."

'It Can't Happen to Me'

But it does happen every day. Jack Malone, owner, and E. V. Brooks, projectionist, of the Casino Theatre in Boonville, Mo., were fatally burned in a projection room fire. A hot soldering iron dropped into a film container, igniting the men's clothes. The two flaming torches ran into the street crying for help. They were rushed to the hospital, where they died within a short time.

FACTORS AFFECTING THE USEFUL LIFE OF PICTURE SCREENS

ONE cubic inch of air contains 150,000 particles of dust. In cities a large part of the dust is coal dust containing sulphuric and hydrochloric acid. Dust and soot destroys everything with which it comes in contact. A sound screen is porous. The air goes through the screen, and the dust and dirt stay on the surface. As time goes on the density of the dust accumulation is increased to a point where it becomes conspicuous as black streaks, smudges and discolorations.

In the winter, the stage or platform is generally colder than the auditorium. The screen becomes chilled, resulting in a slight condensation of moisture on the surface. Although the condensation may not be perceptible to the eye or the touch, it is sufficient to cause the dust in the air to adhere to the screen.

Dust forms a film on the surface of the screen, and each day this film gets thicker until it is a dark gray in color. As the dust gets thicker the projected screen light gets dimmer, the picture becomes dull and hazy, and it becomes increasingly difficult to get the picture in sharp focus.

The gradual loss of light brilliancy due to dust makes it necessary to gradually increase the amperage at the arc. This means shorter life to the carbons, and a greater current consumption. Dust also filters into the tiny sound holes, gradually closing them up, or at least reducing their size. This means a loss of sound volume in direct proportion to the extent to which the holes are clogged.

As the dust gradually clogs up the holes, it becomes necessary to increase the volume of sound. This causes strain on the tubes and other amplifier parts, shortening their life. When higher voltages are applied to the tubes in order to force the sound through the clogged sound holes, overloading is inevitable, resulting in unnatural, distorted sound quality.

Sound screens can be cleaned, but it is a process that requires skilled help to make it successful. All there is to say on this topic was said in INTERNATIONAL PROJECTIONIST for September, 1933:

"There is no satisfactory way of cleaning a screen despite many assertions that screens can be washed. Considered from the purely technical angle, it is impossible to wash a screen. The fabric itself is washable and can be cleaned easily, but it is impossible to remove all of the dirt from so large an area, evenly and uniformly, without leaving streaks.

"The question of cleaning resolves itself down to the ability of an individual to remove the dirt *uniformly* from a large area. The particular cleanser used has very little bearing upon the subject, as a screen can be washed with equal results with any reliable soap dissolved in warm water, the solution being applied with a sponge and the screen rinsed off with clean water. *Good results apply only to small areas, however.*

"While opinions vary as to the life of a sound screen, it has been definitely established that discoloration caused by age, dust and dirt reduced the reflection value an average of 10% every three months. This makes a total of 40% in a year. In cities and manufacturing centers the loss in reflection value is even greater.

"The importance of this loss can well be understood if it is considered that the average perforated screen, when new, has a reflection value averaging 75%. Under extremely favorable conditions, this represents 10 foot-candles. A 40% loss in reflection value means practically cutting the brilliancy of the picture in half.

"The projectionist and the house staff become so accustomed to the appearance of the screen that they do not realize the gradual loss of light that is taking place day after day. Loss of light begins as soon as the screen is installed, and continues to accrue as long as it is in use.

"The conditions obtaining at the theatre with respect to the care given the screen, the dust in the house, chemical conditions of the atmosphere, etc., all control the useful life of the screen. It is safe to say, therefore, that the maximum useful life is from one to two years, though it can be readily proven that the majority of theatres would save considerable money in current and carbon consumption if the screen were replaced at least once a year."

S.M.P.E. Fall Convention, Wardman Park Hotel, Washington, D. C., October 21-24.

OPERATING HINTS

Don't fail to keep the commutator and brushes on the motor perfectly clean.

Don't neglect the arc lamp connections. High amperage eventually chars the asbestos leads nearest the lamp and efficiency requires careful attention to the connections.

Don't use oil or grease on lamp joints or rods. Use a little powdered graphite, or a grease graphite, at the joints.

Don't expect good results with dirty or pitted carbon jaws.

Don't run projector with magazine doors open.

Don't allow cold air draughts from a fan or other sources to blow into the lamphouse. Such a draught will invariably cause condenser breakage.

Don't screw up condenser rings and holder tightly.

Don't fail to wash sprocket teeth at least twice a week with stiff bristled tooth brush dipped in kerosene.

Don't fail to match "0" marks when replacing intermittent.

Don't fail to keep pad rollers adjusted to two thicknesses of film.

Don't bend the intermittent guide apron. To do so will cause serious film damage.

Don't forget to oil the take-up spindle.

MODEL ROOM LAYOUT BY S.M.P.E. COMMITTEE

(Continued from page 18)

accommodate all the film in use in the theatre at any one time shall be installed. The film shall be kept in such cabinets at all times except when being projected or rewound. Any film in addition to that being used for the current show or in excess of that permitted by the local authorities, shall be kept in the original shipping containers.

Fire Protection

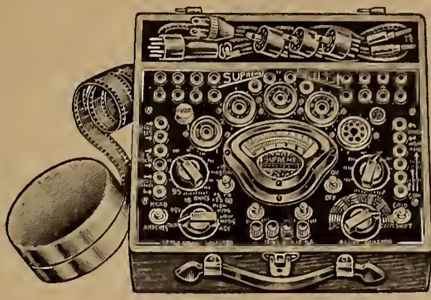
Port Shutters.—These shall be constructed of iron guides not thinner than 16-gauge, built up of iron flats, 2 inches wide and ⅛ inch thick, with spacers 1 inch wide and ¼ inch thick, in which the shutter may slide. The shutter shall be made of not less than 10-gauge iron, or of other approved fireproof material. The bottom sill of shutter tracks shall be provided with leather bumpers to minimize the shocks when the shutter drops.

One type of mechanism for the shutter system having the approval of the Committee consists of a suitable rod which may be constructed of 1½-inch pipe mounted upon the front wall of the projection room in a series of ball-bearing brackets in such a manner that the rod may revolve freely in the bearings.

The shutter system shall be located a sufficient distance below the ceiling line to admit of easy operation. At each port, and securely fastened thereto, shall be a chain or rod of approved design attached to a metal ring fitting loosely over a pin inserted into the rod about 45 degrees upward from the horizontal, so that the revolving of the rod shall cause the pin to fall to a down-vertical position and permit the ring to slip off and drop the shutter.

Into each shutter cord or chain shall be inserted an approved fusible link. The master control cord shall be so arranged through a system of pulleys in conjunction with a counterweight that either automatic or manual operation will permit the shutters to drop. The master manual control cord shall be located at each of the entrances of the projection room. In addition, the master control cord shall be furnished with fusible links placed approximately 10 or 12 inches above and immediately upon the center line of the projector magazine. All larger shutters shall be provided with an additional counterweight to facilitate manual operation of these shutters.

Emergency Exhaust Fan.—An exhaust fan of sufficient capacity to remove all smoke and gas in case of fire shall be provided, and this fan shall be so con-



SUPREME 391

P.A. ANALYZER

Especially Designed for Servicing Sound Film and Public Address Equipment

QUICK FACTS

1. DECIBEL RANGES

— 10 DB to + 20 DB
+ 5 DB to + 35 DB
referred to zero level of six milliwatts in 500 ohm line.

2. D.C. VOLTAGE RANGES

(1000 ohms per volt)

0 to 5 volts
0 to 25 volts
0 to 125 volts
0 to 250 volts
0 to 500 volts
0 to 1250 volts

3. A.C. VOLTAGE RANGES

(1000 ohms per volt)

0 to 5 volts
0 to 25 volts
0 to 125 volts
0 to 250 volts
0 to 500 volts
0 to 1250 volts

4. RESISTANCE RANGES

0 to 500 ohms
0 to 5,000 ohms
0 to 50,000 ohms
0 to 500,000 ohms
0 to 5,000,000 ohms
0 to 50,000,000 ohms

5. CAPACITY RANGES (Low)

0.0000125 to 0.00125 mfds.
0.00005 to 0.005 mfds.
0.000125 to 0.0125 mfds.
0.0005 to 0.05 mfds.
0.00125 to 0.125 mfds.

6. CAPACITY RANGES (High)

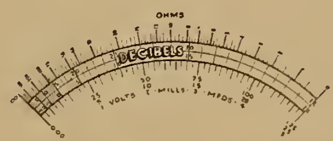
0.005 to 0.5 mfds.
0.0125 to 1.25 mfds.
0.05 to 5.0 mfds.
0.125 to 12.5 mfds.
0.5 to 50.0 mfds.

QUICK FACTS

7. DIRECT CURRENTS

0—250 microamperes

0 to 1.25 ma.
0 to 5.0 ma.
0 to 25.0 ma.
0 to 125.0 ma.
0 to 250.0 ma.
0 to 500.0 ma.
0 to 1.25 amp.
0 to 5.0 amp.
0 to 12.5 amp.



The 391 Meter Dial. Note evenly divided scale for voltage, current, and capacity readings, and the convenient division of ranges, so that values occurring most often are near the center of the scale or above. The DECIBEL section is of different color than the remainder of the scale, attracting the eye when measuring power levels.

The ohmmeter scale has been so chosen that the ranges overlap considerably, hence a range can always be found which will give a good needle deflection for any resistor up to at least 10 megohms, and values up to 50 megohms can be read with but little trouble.

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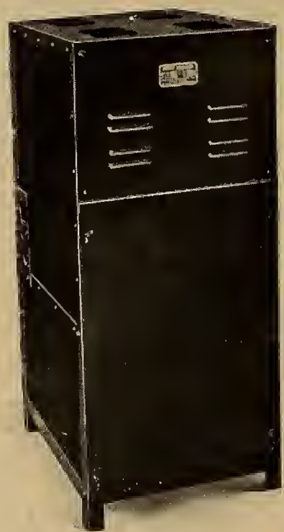

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FOREST MANUFACTURING CORP.
Manufacturing Rectifier Specialists
Belleville U. S. A. New Jersey

nected to the port shutter controls that its full capacity will be automatically made available upon the dropping of the shutters. The fan and air duct shall be of fire-proof construction and located in accordance with local requirements.

Doors.—The doors shall be an approved metal or metal-clad type, swinging outward from the projection room, and shall be provided with door-checks or other approved door-closing devices.

Two Exits Recommended

Exits.—Exits shall be provided strictly in accordance with local authorities having jurisdiction, particularly with reference to size and location. It is recommended that never less than two exits from the projection room be provided. At least one of these exits should be of the conventional stairway type, with risers not in excess of 8 inches and a minimum tread to each step of not less than 9 inches, and of sufficient size to permit transportation of equipment.

It is recommended that the secondary exit provide a means of access to the ground. This exit to the outer air may be by means of a roof scuttle or doorway to which access can be had from the projection room by means of steps or a ladder.

Windows.—Where a projection room is built against the exterior wall of a structure, one or more windows should be provided in such wall.

Fire Extinguisher Equipment.—The local authorities having jurisdiction should be consulted regarding the proper type, number, and location of fire extinguishing equipment.

J. O. BAKER, *Chairman*

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for the best and most complete stock of theatre equipment—including visual and sound projection supplies—at the leading independent theatre supply house in the Middle West.

TECHNICAL ASPECTS OF RECORDING PROCESS

(*Continued from page* 13)

with sound, until today practically everything is released only upon film.

The 'Dubbing' Operation

The fact that in early pictures only certain scenes were recorded with dialog, because other scenes had already been photographed and could be retaken only at great expense, brought into operation a system called "dubbing." The operations were essentially these: a sequence already photographed was projected upon a screen; the characters who originally appeared in that scene were assembled before the screen, and each at the proper time spoke his lines into a microphone, and the voices were recorded upon a recording machine which was electrically synchronized with the projector. The resulting sound-track was then printed with the picture and the result was a sound picture.

Sometimes the audience wondered why the lip motion of the characters upon the screen seemed to be ahead of or behind the voice, but for the most part the illusion was adequate to "get by," largely because of the novelty of the entertainment.

The next step was the substitution of voices. If a character had a poor recording voice, why couldn't a good voice be used instead? It could, and was in many instances done. It was only a short time until a beautiful girl who couldn't carry a tune in a basket appeared upon the screen to be singing with all the assurance and delightfulness of a grand opera star. As many a star of the olden days was provided with a double for risky or dangerous stunts, so was an inarticulate star of the new regime provided with a vocal double whose tender tones added additional charm to the already popular screen personality. At present, however, little or no vocal substitution is done in pictures for the stars whose names grace the marquees.

Considerable Dubbing Now

There is, however, a very considerable amount of dubbing now being done by all studios. During the filming of a scene there may be reasons why a good recording of a voice is impossible to obtain, and in such instances the scene is shot silent and the voice recorded later. The speaker watches the projected picture and speaks into a microphone, fitting his phrases to the lip motion of the character upon the screen. The sound-track is later printed with the picture.

Making musical films presents a multitude of problems, each of which requires its own solution and not any of which is present in making an ordinary talking picture in which only dialog is to be recorded. In many instances, a musical picture is more or less spectacular inasmuch as it involves magnificent, lavish sets, hundreds of persons, and a great deal of action. The principals must, of course, have their share of close-ups, and almost invariably there are scenes involving the principals and a large chorus at the same time.

To record an entire musical satisfactorily thus becomes a major problem, and requires untold ingenuity upon the part of the sound department.

Consider, for example, the filming of one scene of a typical musical. There is usually a prima donna, a leading man who sings, perhaps a trio or a quartette supporting the two, and a mixed chorus in the background.

In order to accommodate such a large cast the set must necessarily be large. It is usually photographed with anywhere from three to six cameras, each of which uses a lens of different focal-length. Hundreds of incandescent lamps and arcs pour light into the set, and when everything else is ready, the unfortunate sound man is faced with the task of putting a microphone, or a series of microphones, in places where he can

FOLLOW THE EXAMPLE OF SUCCESSFUL THEATRES

USE NATIONAL HIGH INTENSITY PROJECTOR CARBONS

HIGH Intensity Projection allows ample general illumination for comfortable vision from the moment of entrance into the theatre. It dispels that annoying period of blindness. Patrons appreciate the ability to find their seats without stumbling or groping.

National High Intensity Projector Carbons, in addition to comfortable vision, bring the further satisfaction of perfect projection. They improve the depth and realism of black and white and make colored pictures especially pleasing.

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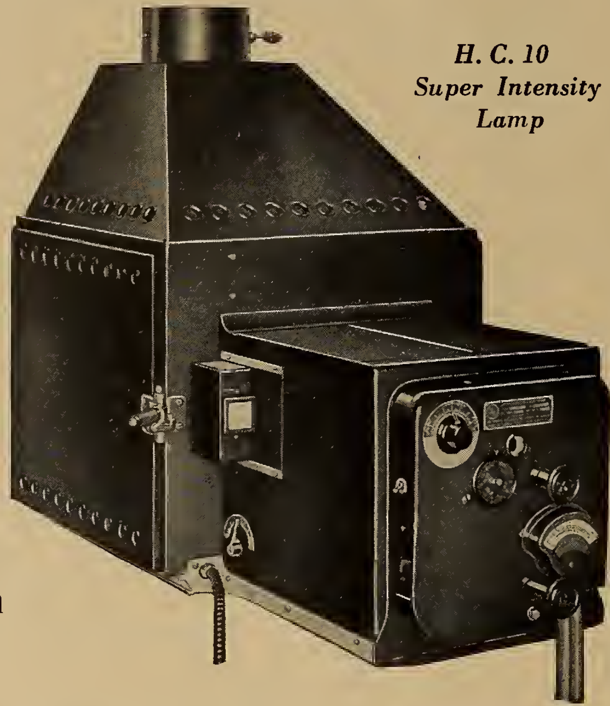

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secure a good sound pick-up and, at the same time, not cast shadows upon the scene or the actors. The chances of his accomplishing this are somewhat less than zero and, consequently, he has to resort to quite different means.

Large Set Difficulties

On such a problem the sound man is severely handicapped. The cameraman can set his camera in any one of a dozen positions, close to or considerably removed from the object or objects to be photographed, and by choosing any of half a dozen different lenses, he can attain the desired photographic result. The sound man, on the other hand, is forced to use a metal ear in the form of a microphone, and no matter how many microphones he may use, or try to use, he is able to accomplish only the effect of dividing a single ear into that many parts.

Where it is possible to photograph a close-up and a long shot with two cameras simultaneously and secure excellent results in each case, a sound man can record either close-up quality or long-shot quality. He can not have both, because he has but a single recording channel with which to work.

In order to overcome such a condition and to record successfully in spite of the very definite limitations imposed upon him due to this "distance factor," the sound engineer is compelled to resort to all sorts of manipulations. The fact that he has at his disposal a recording channel with certain predetermined electrical characteristics that remain constant does not alter or improve the situation continually confronting him in his attempt to make a single sound record match a half dozen different camera shots of a single scene.

It is comparatively easy in a broadcasting studio, where sound is of paramount importance, to secure the proper voice quality and balance, because there the microphone can be placed in an optimal position with respect to the speaker, singer, or other sources of sound. Upon a motion picture set, however, obtaining a satisfactory pick-up becomes an entirely different matter. In broadcasting, a microphone can be placed where it will do the most good, and usually that place is directly in front of the artist. In pictures such a placement is obviously impossible, and the microphone must be placed above and in front of the speaker. This immediately brings in at least two distinct complications.

The first is the matter of shadows, for no matter what else happens one can not have shadows upon either the face or the clothes of the artist, nor on the walls or furnishings of the set. In the event that the subject stands still during the take, there is ordinarily little likelihood of shadow trouble; but if the action involves movement by the artist, then the difficulty of avoiding shadows is

S.M.P.E. Fall Convention, Wardman Park Hotel, Washington, D. C., October 21-24.

greatly increased because most of the set lighting is from overhead.

The second problem confronting the sound man has to do with a change of voice quality as the microphone is moved with respect to the speaker. In real life we are accustomed to listen to a speaker from a position somewhat directly in front of him. In pictures we listen to him from a position above his head, since this is where the microphone is invariably placed. As long as the microphone is fairly close to the speaker it receives a large amount of direct sounds and very little of reflected or indirect sounds. As the distance between the microphone and the speaker increases, the amount of direct sound picked up decreases and the amount of indirect sound reflected by the walls and floor of the set increases. This produces a very definite quality difference which is much more noticeable with a microphone pick-up than when listening with unaided ears. In the former case the reverberation appears to be much greater; and if the microphone is moved too far away from the sound source, the reflected or indirect sounds increase to such an extent as to render the recording altogether unsatisfactory.

Fortunately for the sound man, it is seldom in these days that a director will insist upon shooting a close-up camera and a long shot camera at the same time. It is usually only on large spectacular shots that more than one camera is used, and in such instances only mass sounds or crowd noises are recorded when the picture is photographed.

Long and Close Shots

Assume a typical case: the proposed action requires that the two principals be found sitting upon a bench in a garden. Romance is in the air, and under the soft moonlight the hero pours out his heart in a love song. He sings a verse and a chorus. She sings a chorus, then they sing a duet, and while they are singing a group of beautiful girls come into the picture, dance through a chorus, and the scene ends with a grand ensemble of all the voices and a full orchestra.

In general, this is how such a scene would be made. Several days before the scene is to be photographed, the orchestra and singers are assembled in the recording room where all music is recorded. Several sound-tracks are made of the vocalists accompanied by the orchestra, and if there is to be a dance chorus, there is a recording of the orchestra alone. The following day the sound-tracks are heard by those concerned and the most most suitable as to tempo, rendition, *etc.*, is selected.

A print of this recording is then taken to the set on the day when the picture is to be photographed, and used for playback purposes. The cast is assembled upon the set, and the record is played back to them as many times as necessary for rehearsal. When the routines are established and everything is in order, the scene is shot with cameras only while the cast go through the action to the recorded music from the reproducer, which is electrically interlocked with the cameras. When close-up shots of the principals are desired, the cameras are moved into position and the scene is repeated either wholly or in part, but each time to the same playback record.

By this means any number of camera angles can be obtained. Later, any combination of these shots can be intercut, and the final assembly will match, not only as to pitch and tempo, but the action and sound will be perfectly synchronized as well, since all the picture cuts are printed with the original soundtrack. Of course, it is important that during close-up shots the artist be careful to move his lips to conform to the words coming from the playback horns. In the event that either or all the principals can not sing, it is easy to substitute singing voices of other artists during the original recording and the scene is shot with the screen star before the camera and the sound-track of the other voice on the playback machine. This method is usually known as "pre-scoring."

There are many other ways by which these results may be accomplished and it may be of interest to discuss some of

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them briefly. One way is to make a recording of an orchestra only, playing an arrangement in the form of an accompaniment for a song. At another time, perhaps weeks later, a singer goes into the recording room and makes a record of the words of the song while listening to the orchestral accompaniment in a pair of ear-phones. The two records upon separate films can then be re-recorded into a single track of voice and orchestra. The combined track may then be played back upon a set while the artist does the scene before the cameras. This picture may then be printed with the re-recorded sound-track to produce a composite film.

This method has the advantage that it permits the balance between the voice and the orchestra to be altered at will during the re-recording process. For example, if an orchestra is shown in the picture and the singer moves about, perhaps to some distance from the orchestra, while the camera moves with him, the illusion is aided by dropping the orchestra level while still holding the voice at a normal level.

Another method is to record a piano track of the selection to be used in the picture and reproduce this track upon the set at a volume level just loud enough for the artist to hear while he does his routine or song before the cameras and microphone. The picture and the piano track are then taken to the re-recording department where an orchestra is assembled. The picture is shown upon a screen in the recording room where a musical director can see it, and as he sees the picture he listens to the piano track over a pair of ear-phones. The reproducing machine and the picture projecture are electrically interlocked, insuring synchronism.

After a few rehearsals a recording is made of the orchestra playing the necessary accompaniment while the director beats time for them to the tempo of the track he hears reproduced in the headphones. Sometimes only the piano track is used and sometimes both the vocal track and the piano track are reproduced for the director. Of course, the microphone during the recording "hears" only the orchestra. At a later time the vocal track shot upon the set and the orchestra track are combined by re-recording and cut into the finished picture.

Variations in Procedure

Another variation in recording technic may be adopted when a singer and an orchestra are available in the recording room. It is always desirable to match long-shot sound with long-shot picture and close-up sound with close-up picture; but when a pre-scoring job is done, no one knows when and where the picture will be cut to these shots because no picture has yet been made. If now recordings are made of the singer and orchestra with close-up quality throughout, this sound will not match a long-shot picture when they shoot it, and the audiences will experience a feeling of dissatisfaction and will sense the unreality of the illusion, probably without knowing why. On the other hand, if the recording is made with long-shot quality, it will be equally bad when played with a close-up picture. To overcome this trouble and to provide for any amount of cutting later, any combination of three different methods may be used to record the original sound:

(*a*) The sounds may be picked up by a microphone or microphones placed near the singer and orchestra, and called "close-up" quality. At the same time another microphone placed some distance away from the source of sound

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feeds "long-shot" quality sound to a second recording channel and a second recorder which is electrically interlocked with the one on the first channel. Either track may be used later upon the set as a playback while the picture is being photographed, and this reproduced sound recorded upon the set at the same time, but for cueing purposes only when the picture reaches the cutting room.

The picture may then be cut in any desirable way, and when a long-shot scene is used, the corresponding portion of the original long-shot sound-track may be cut in. When a close-up picture is used, original close-up sound-track is used, and the finished picture will then preserve and present to the audience at least a semblance of reality.

(*b*) A modification of this procedure may be made use of as follows: Recordings are made simultaneously with long-shot and close-up microphones, and either track used for playback purposes while the picture is being photographed. However, instead of cutting in long-shot or close-up track into the finished picture, another procedure may be followed. The two tracks are reproduced simultaneously by two high-quality reproducers and re-recorded into a single track. By watching the picture and by means of cue marks, the re-recording engineer can fade in or out either track at will, thus accomplishing electrically what was, in the case of (*a*), done with a pair of shears, and often do a better and smoother job.

Efficient 'Doctoring' Done

(*c*) A third method of creating the desired illusion is to record a single track of the singer and orchestra with microphones so placed as to attain a satisfactory over-all balance with respect to each, and without regard for either close-up or long-shot quality. A print of the track thus made is then used for playback purposes, as in the two preceding illustrations. Whether this reproduced sound is or is not recorded upon the set during the filming is unimportant except for checking synchronization when the "rushes" are screened the following day. A print of the original track is then taken to the re-recording department, reproducd on a high-quality "dummy" and re-recorded. During this re-recording process, however, a little "doctoring" is done.

The sound-track is reproduced from any one of several "dummies," fed into a preliminary equalizing amplifier and thence to a mixer or control panel in the usual way. By means of a simple switching arrangement this signal is divided just ahead of a mixer position, part of it going into the mixer pot and part of it being fed through an amplifying system and into a speaker unit.

The speaker unit is located at one end of a highly reverberant room, or echo chamber—one having hard plaster walls and ceiling and a wooden or concrete floor. The room need not be very large, the shape being more important than the actual cubical content. At some other point in the room is located a microphone which picks up the signal from the speaker. This signal is increased through a regular microphone amplifier and fed back through a trunk-line into another position on the mixer panel.

It is now possible to combine electrically a portion of the original signal from the dummy and another portion of the same signal after it has passed through a time-delay circuit. The time delay is controlled by the distance between the microphone and the speaker in the echo chamber. In addition to the time delay, this chamber, being highly reverberant, imparts a distinct quality change to the original signal. The engineer, by varying the relative amounts of each of these two signals coming into his mixer panel, is able to change the character of the resulting signal from the original quality with little or no reverberation to the other extreme, where it may sound as though the original recording were made in the Grand Central Terminal.

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ERPI ABANDONS GENERAL SERVICINC PLAN

(*Continued from page* 8)

Erpi for an accounting of its profits and practices in this field since 1927?

Some scanty details of this situation having percolated through to the trade press, I. P. is ready now to supply a few facts. Erpi's scheduled legal antagonist is RCA, which since last February has been quitely but thoroughly probing the deep dark recesses of sound equipment merchandising. RCA's findings are most interesting, and most of them have been reduced to affidavit form in preparation for the impending court tangle.

Such distinguished gentlemen as Messrs. Gifford and Sarnoff, kingpins of A. T. & T. and RCA, respectively, have pow-wowed on the topic, it's that important. Early hopes for an amicable settlement of the matter have vanished, RCA's latest move being to retain two of America's largest law firms to represent it.

This writer happens to know the contents of numerous affidavits now in the possession of RCA, and he predicts that if this case ever goes to trial, it will prove to be the worst scandal that ever hit the picture industry. If even a small fraction of the charges set forth in the affidavits are true, not only some engineering personalities but also several exhibition company officials might just as well start running now, it's that hot. RCA and other sound companies may not have been able to get their recording and reproducing equipments into certain companies, but they will spend a lot of money in fees to find out why.

* * *

JUST two more items which will help to fill Erpi's cup of joy to overflowing. The Senate investigation of the A. T. & T. structure, not forgetting the activities of its subsidiary, Erpi will open shortly. Also the House of inquiry into patent manipulations will have opened by the time these lines are read, with A. T. & T. first on the list.

The second item is directed particularly at I. P. readers. All this copy about Erpi was written with a definite purpose in mind, that being that I. P. readers should absorb all this information and broadcast it where it will do the most good. I. P.'s differences with Erpi have their roots in the fight by this publication to keep Erpi from extending its servicing operations in the theatre field, which move, I. P. holds, constituted a very real threat to the welfare and security of the craft.

Projectionist Stand Important

Erpi's attitude toward I. P. is important in that it reflects the displeasure of Erpi because I. P. kept its readers informed and campaigned against a plan which it held to be detrimental to the best interests of the craft. I. P. happens not to care two hoots in a stiff gale about Erpi's attitude toward it; but this is no reason why the craft should relax its vigilance and cease to agitate in favor of those companies whose merchandising policies are more favorable to the craft.

This is the only means through which the drubbing administered to Erpi in this instance can be made to stick. Moreover, the outcome of this fight will serve notice on all others that nobody can be contemptuous of the power and influence of the craft and get away with it. This is the all-important point.

AUSTRALIAN PROJECTION ITEM

While a week of 42 hours is generally considered the limit of an operator's work, numbers of men put in from 12 to 16 hours daily and there are cases on record where they have been kept working for 72 hours in one week. Reviews, some necessary, and many quite unnecessary, are held at all hours of the day and night and frequently on Sundays. In most instances the operators receive no extra pay for this extra work.

An investigation into the position by responsible people shows that the men have a real grievance and that their position has become intolerable. The tactics employed by certain exhibiting firms will undoubtedly have a boomerang effect; they are beginning to feel concerned at the action being taken by the operators. If they knew just what information is in the hands of the Labor Department and the Labor Party they would have reason to be still more alarmed.

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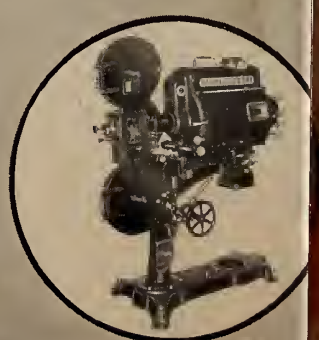

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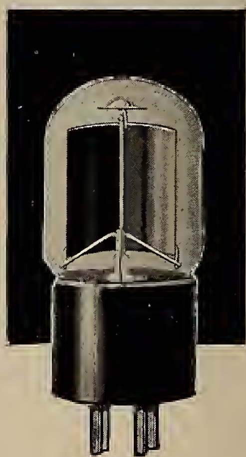

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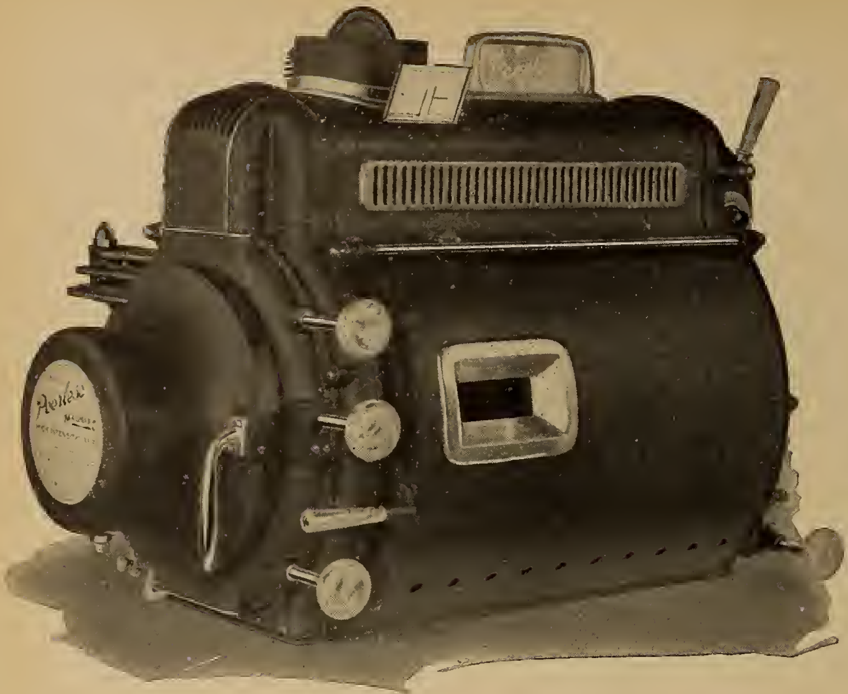

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Edited by James J. Finn

Volume 9 OCTOBER 1935 *No. 4*

Index and Monthly Chat 5

Atlas Bid for Erpi Reported; RCA-Erpi Peace Near 7
JAMES J. FINN

Accurate Running Time Gauge 8

Screen Symposium, Color, Third Dimension Feature S.M.P.E. Meeting 11

S.M.P.E. Notes 12

Some Operating Characteristics of the Suprex Carbon Arc .. 13
CLARENCE S. ASHCRAFT

Step-By-Step Analysis of Sound Reproducing Equipment, XV 17
AARON NADEL

Some Projects Outlined By S.M.P.E. Committee 20

Notes From the Supply Field .. 21

Shutter Elimination, Double Present Light Forecast for Mercury Vapor 22

Mystery of Feature Leader Close-Up Solved by M-G-M Technician 22

News of the Month 25

Technical Hints

Miscellaneous Items

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MONTHLY CHAT

WHATEVER the outcome of current negotiations for the sale of existing sound companies, as reported elsewhere in this issue, it is plain that the sound picture equipment racket is dead. Gone beyond recall are $25,000 installations, which carried compulsory weekly service charges ranging from $40 to $15. Gone, too, is the replacement parts racket with a single tube costing $65.

PROJECTIONISTS are not entitled to any orchids for their attitude toward sound pictures since 1928. By 1930 the craft should have had efficient men available to put a stop to the equipment servicing racket; yet it was not until late in 1934 that the craft made any move to obtain this work. This delinquency aided and abetted the servicing graft, in addition to showing up clearly craft shortcomings.

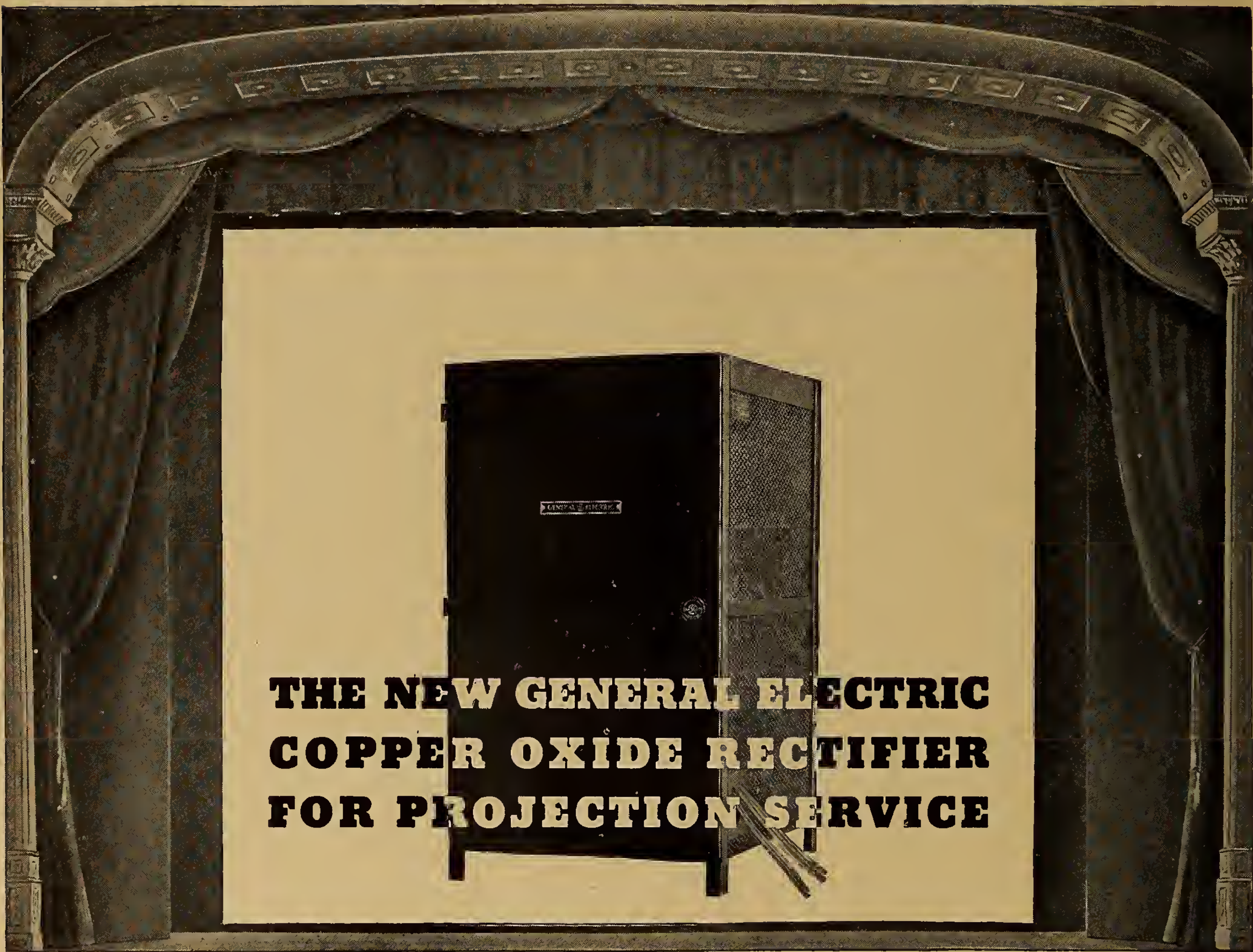
EVEN now the craft is strangely apathetic to the opportunities for added profit and security through servicing operations. If the craft be not organized for this twin purpose, then pray for what else? I. P.'s oft-repeated warning still holds good: If the craft does not move to take over this work, others will; and by "others" we don't mean the electrics!

THERE will be other developments similar to, if not as far-reaching as, sound pictures. Color, new sources of illumination, three-dimensional pictures, new projector mechanisms (not forgetting television in the background)—these are just a few new wrinkles impending. Certain influences now formulating large-scale plans for the motion picture field won't be so patient with the craft as have been their predecessors, and they certainly will not permit any "break-in" periods. Either the craft will have it, or it won't; and if the latter be the case—look out!

IS THIS a sermon? Certainly it is. We dislike having to say it, but it is an indisputable fact, proved by experiences of the past, that recent widespread wage increases for the craft will again invite the danger of lassitude and increasing flabbiness, induced by that well-known feeling of security the result of a bulkier weekly envelope.

THE sound field promises to be cracked wide open by the end of this year, on equipment sales as well as on servicing. Either the craft looms large in this picture, or it doesn't. Either it has what it takes, or it hasn't. This corner can't make the decision.

I. P. is now working with several insurance companies with a view to effecting a further reduction in projectionist insurance rates, which for years have been way up in the higher brackets. Readers having data that they think will be helpful are urged to submit it as soon as possible.



A new design from top to bottom using a tried and proven principle of rectification that will adequately meet the exacting requirements of the new Suprex Arc. It enables the projectionist to obtain the maximum advantage and light-efficiency from this superb new arc.

Three-phase, full-wave rectification delivers a smooth, uniform, direct current to the arc.

Two sizes available — 40-50 amperes for the 6-7 mm. trim and 50-65 amperes for the 6.5-8 mm. trim.

A permanent type of rectifying unit that requires no maintenance or replacements. First cost is the only cost.

High efficiency. Will save from 5 to 10 cents per hour in cost of current over other types of D-c. power equipment.

The attached coupon will bring you complete details of this newest General Electric product.

Section A-6010, Merchandise Department
General Electric Company, Bridgeport, Conn.

Please send me complete information on the new G-E Copper Oxide Rectifier for projection service.

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INTERNATIONAL PROJECTIONIST

VOLUME IX NUMBER 4

OCTOBER 1935

Atlas Bid for Erpi Reported; RCA-Erpi Peace Near

Powerful New York Financial Group, With Present Extensive Amusement Holdings, Reported Bidding for Sound Picture Company Control . . . Basis of RCA-Erpi Fight Settlement Reported as Certain to Eliminate All Restrictive Licensee Agreements

By JAMES J. FINN

NEGOTIATIONS looking toward the purchase of Electrical Research Products, Inc. (Erpi) were initiated several months ago by the Atlas Corporation, according to reports impossible of verification reaching INTERNATIONAL PROJECTIONIST. Just how much success attended the Atlas efforts in this direction is not known, although latest reports have it that the deal has cooled considerably.

Atlas Corporation, a holding company controlled by New York financiers, already has extensive holdings and powerful influence in Paramount, in Fox and in RKO, entry into the latter company having been gained by Atlas paying RCA some $5,000,000 for a half interest and holding an option for the other half at a similar figure. Chase National Bank (N. Y.) still is the largest Fox stockholder, but Atlas has an important voice in its management.

If it could obtain Erpi, Atlas would move into a dominant position in the motion picture producing, exhibiting and equipment fields. The one discordant element in the pattern of reported Atlas ambitions, however, is the persistent rumor that Atlas, far from desiring expansion of its picture holdings, actually is wending its way out of Paramount. Logic, then, dictates the conclusion: if no Paramount, then certainly no Erpi.

American Telephone & Telegraph Co. has long been represented as desirous of cutting itself loose from Erpi. A. T. & T.'s primary interest lies in communications (telephones), and it is inconceivable that the company would permit anything—even a highly-valued subsidiary such as Erpi—to interfere even slightly with the orderly advancement of its major interest.

Support for this representation of company policy came recently from none other than President Walter Gifford of A. T. & T. during the course of a hearing before a governmental agency when he declared it had always been his belief that the telephone company should not engage in any business outside the public utility field—meaning telephones.

Events of late 1934 and of this year to date undoubtedly fortified Mr. Gifford in this belief, because Erpi has been figuratively battered from pillar to post during this period, with the recent RCA difficulty and threat of suit possibly shaping up as the last straw.

Erpi's Troubled Course

During the past year storm clouds have mounted in ever-increasing numbers on the Erpi horizon. First, there was the Warner-Duovac-General Talking Picture suit in Wilmington, Del., in which Erpi was accused of practices in restraint of trade and of fostering a monopoly in the sound picture field. Triple damages were asked by the plaintiffs. Warner Bros. withdrew from this proceeding; and Erpi itself announced that it paid Warners $4,000,000 cash to settle

all outstanding difficulties, including the Vitaphone royalty squabble.

Warners followed this up by dispensing with Erpi servicing in its theatres, with Loew's Theatres following suit on Jan. 1 of this year. These terrific dents in the Erpi servicing armour developed into definite cracks when numerous other theatres followed the Loew and Warner lead. With sales of new theatre sets at low tide (except for Wide Range conversion jobs), Erpi income declined sharply.

Meanwhile, a decision in the Wilmington suit of Duovac-General Talking Picture against Erpi is expected shortly, with close observers holding that the plaintiffs have better than an even chance of success.

As though this were not enough, there still confronts Erpi the impending investigation by the Federal Communications Commission into the structure and *modus operandi* of A. T. & T., with particular emphasis upon sound picture field activities—which means Erpi. The motions gone through by the Commission to date indicate that Erpi will be accorded the major share of attention, the outcrys against the W. E. affiliate having been long and loud.

Whatever course is ultimately followed by Erpi, it is difficult to discount the great importance to Erpi of the menacing gestures made by RCA during recent months. Having finally concluded that it was being blocked out of both the studio recording and theatre reproducing fields through methods which it allegedly considered unfair, RCA informed Erpi of its intention to spend plenty of money in legal fees to find out why.

As previously stated herein, some of the charges documented by RCA, if substantiated through court proceedings, would create a major sensation in the picture business and occasion new biographies of several distinguished industry personalities.

RCA-Erpi Settlement

The RCA-Erpi difficulty is understood now to be in the process of settlement, I. P. being reliably informed that settlement hinges upon acceptance of reported RCA demands as follows:

1. Payment by Erpi of damages approximating $3,000,000.

2. Erpi to notify all theatre licensees that all restrictive agreements are abrogated forthwith. This is to include servicing and all repair and replacement parts agreements (commonly known as the R & R contract).

3. Erpi to cease and desist from practices alleged by RCA to have damaged it in the past.

All this sparring about the theatre field business is so much nonsense, of course, because there isn't enough profit in theatre sound systems these days to excite either Erpi or RCA—that is, after the present servicing charges are deflated, as they appear certain to be. The cream is gone.

That which concerns both RCA and Erpi at present is not the theatre field but the recording field—that item of $700 per reel royalty which accrues to the licensor. So much for the RCA-Erpi tangle.

Variety reports that A. T. & T. would like to dispose of Erpi, the deal being a matter only of price because of the necessity for realizing something for the communications company stockholders. At the hearings of the Congressional Patents Committee in New York recently, one of the committee members observed that a continuation of the policies pursued by Erpi in the sound field to date would ultimately lead to governmental control of the telephone company.

Considering the implications of this comment, the important question of the moment is: Will Papa A. T. & T. risk possible governmental interference with his major interest (telephones) through having somebody or other hang something or other, either rightly or wrongly, onto his child Erpi? The logical answer is that Papa positively will do nothing of the sort.

Possible New Set-Up

All of which brings us back by a somewhat circuitous route to the set-up that would prevail should Atlas be successful in its reported attempt to purchase Erpi. Atlas would be expected to dodge any contingent liabilities in the nature of possible damages on patents or anything else, but beyond this the picture would look something like this:

A. T. & T. could retain its sound picture interests strictly as a licensor, with no operating headaches and having only to collect royalties.

Atlas, through its already extensive holdings in production and in exhibition, would have a ready-made outlet for existing and other theatre equipment products that might be developed. Not forgetting the ever-expanding industrial and educational sound picture fields.

Atlas could undoubtedly operate a sound picture company much more economically than could A. T. & T., what with certain research and other typically big-organization posts expenses eliminated.

NOVEL FILM RUNNING TIME GAUGE

EVIDENTLY dissatisfied with the various proposals cited herein for accurately judging film footage, two enterprising projectionists in York, Penna., could restrain themselves no longer and submit the following scheme for solving this oftentimes vexing problem. Their communication follows:

"We have been reading with much interest the discussion of how best to judge the running time of a show before projecting. We have overcome this problem in a manner that we thought would interest other projectionists.

"First we obtained a piece of hard wood about 1 foot long and a half-inch square. Next we fitted onto this piece a block 2¼ x 1 x ⅜ inches, which would slide easily up and down. We then set a pin in each end to prevent the block from sliding off. We now had a rule, minus calibrations.

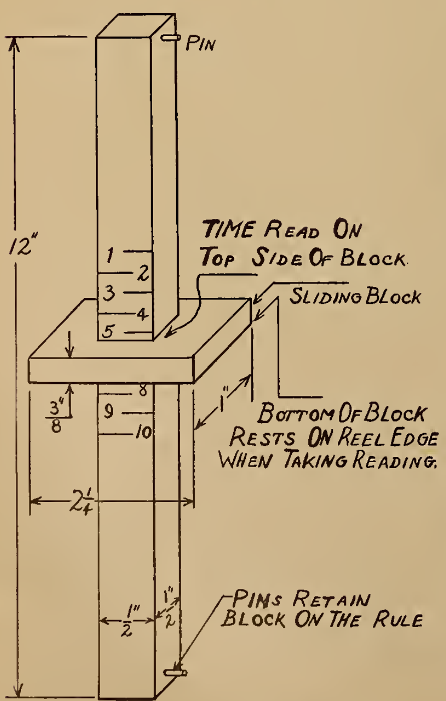
"To calibrate our rule, we first threaded one projector with a full reel. We started the projector and each minute thereafter placed a thin piece of paper between the film on the take-up reel. After the reel was off we thus had paper markings for each minute of running time, or 90 feet of film.

Rule Is Easily Calibrated

"By means of the paper slips it was an easy matter to calibrate our block rule right on up to 22 minutes of running time. Now when we get a show we place it on our own reels, and by using our own rule we can gauge the running time right on the nose. In fact, we have never been more than one minute off on any full show. The accompanying sketch gives the dimensions for this film rule.

"It is important, of course, that the projectionist use his own reels which are alike as to hub size, etc."

LESTER W. SHAFFER, EMORY MYERS
Strand Theatre, York, Pa.



Dimensions for film gauge

40-65 Ampere D. C.

HIGH INTENSITY PROJECTION

is made possible by

NATIONAL Suprex CARBONS

FOR ALL HIGH INTENSITY LAMPS WITH NON-ROTATING POSITIVES

HIGH Intensity Projection permits ample supplementary lighting for comfortable vision from the moment the patron enters the theatre. It dispels those annoying moments of blindness. It eliminates stumbling and groping for seats.

The brilliant, snow-white light from National SUPREX Carbons improves the depth and realism of black and white productions and reveals the full beauty of color photography.

NATIONAL

PROJECTOR CARBONS

FOR EVERY TYPE OF PROJECTION LAMP

NATIONAL CARBON COMPANY, INC.

Carbon Sales Division, Cleveland, Ohio

Unit of Union Carbide UCC and Carbon Corporation

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New York ✧ Pittsburgh ✧ Chicago ✧ San Francisco

Let PERFORMANCE Be Your Guide

WITH the success of your theatre depending largely on the quality of light on the screen, your projection lamps are a most important item.

• •

Bear in mind—Brenkert projection lamps perform in the broadest sense of the word.

• •

Brenkert users—large circuits and independent theatres from coast to coast—have discovered this to their complete satisfaction.

• •

Begin now to enjoy the full benefits derived only from Brenkert ownership.

• •

Brenkert distributors cover the country and will gladly demonstrate in your theatre at no obligation to you.

The name BRENKERT on a projection arc lamp is your guarantee of advanced design and construction, ease and accuracy of operation, stability and ruggedness, and economy. See and test this lamp—today!

Contact the distributor nearest you, or write direct to us for full details.

BRENKERT LIGHT PROJECTION CO.

Engineers and Manufacturers

7348 St. Aubin Avenue Detroit, Michigan

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The Brenkert plant is the largest arc lamp manufacturing plant in the industry. Brenkert projection lamps enjoy world-wide sale.

★ Screen Symposium, Color, Third Dimension Feature S.M.P.E. Meet

PRACTICALLY every phase of motion picture engineering was covered in the course of a well diversified papers program at the convention of the Society of Motion Picture Engineers in Washington, D. C., Oct. 20-24. Probably the outstanding feature of the convention was the participation therein and close cooperation of numerous Government officials, who contributed about 10 papers to the program.

The steadily increasing interest in things motion picture exhibited by the Government indicates the many and varied uses to which the motion picture is being put by numerous U. S. educational and scientific branches.

Of particular interest to projectionists and others concerned primarily with theatre reproduction was the session devoted exclusively to a symposium on screen brightness, heretofore one of the most vexing topics on the Society agenda.

Homer G. Tasker, of United Research Corp., was again named president of the Society for a term of one year. The only change in directing personnel was the election of Dr. A. Hardy, of M. I. T., to the Board of Governors, succeeding Dr. W. B. Rayton, of Bausch & Lomb. Herbert Griffin, of International Projector Corp., was again named to the Board for a full three-year term.

Will H. Hays, head of the Association of Motion Picture Producers and Distributors of America, speaking at the semi-annual banquet of the Society, unloosed prophetic remarks anent the imminence of three-dimensional movies, color that is truly natural, and sound reproduction in theatres that will compare favorably with the best results obtainable in leading opera houses. The movie leader also predicted a rapid rise in educational film activities, stating that the future text book will be of celluloid as well as paper, ink, and binding.

The S.M.P.E. Progress Medal, awarded for the first time, went to Dr. Edward C. Wente, of the Bell Telephone Laboratories, for his work in acoustics with special emphasis upon sound reproducing systems. The *Journal* award for the outstanding paper of the year was made to Dr. Lloyd A. Jones and Dr. Julian Webb for their paper, "Reciprocity Law Failure in Photographic Exposure." Honorable mention was gained by J. I. Crabtree, H. E. Edgerton, E. J. Gemeshausen, O. Sandvik, V. C. Ball, W. K. Grimwood, D. B. Joy and A. C. Downs, the latter two associated with National Carbon Co.

Review of Papers

Appended hereto are brief reviews of those papers of especial interest to I. P. readers, although not necessarily in the order of their importance:

Numerous projection faults in theatres comprising even some of the larger chains are due to lack of efficient projection supervision, declared F. H. Richardson in detailing some of the requirements for such a department. He added that a projection office should have detailed records of not only the larger equipment items but also of the component parts thereof and particularly of those units which are subject to constant wear.

"The Conquest of Color", by Howard Ketcham, echoed the opinion expressed in these columns some months ago and advanced reasons why the motion picture was not ready yet for color. Said Mr. Ketcham:

"Color movies are in keeping with the revolutionary changes in industry, such as streamlined trains, Diesel engines, synthetic enamels, and beer in cans. When will colored movies replace black and white? When they embody a means of reproducing color with fidelity throughout the entire range of the visible spectrum; when color costs approximate black-and-white production figures and represent a minimum change in production technique. Then and then only will color photography replace black-and-white moving pictures on a permanent basis.

"The time is not far distant when color pictures will be made with no additional illumination on the outdoor set, no special cameras or cameramen. On the set, actors and actresses will need no other make-up than is normally worn on the street. The reproduction of flesh tones will be so faithful as to show the slightest variation of powder white or olive tint.

"The more color sensations the eye receives, and the fidelity with which they are transmitted, controls, to a degree, the fatigue of the eye. For this reason, a color picture process that employs tnree colors is less tiring than a two-color process; and a four-color process is less tiring than a three-color process".

J. R. Manheimer, of the E-J Electric Co., contractors on some of New York's largest theatre projects, contributed a paper on electronic-tube control of stage lighting by means of equipment requiring only one operator. Details of the switchboard, of particular interest to stagehands, follow:

1.—The pilot board, which contains the levers and switches, that are under the immediate control of the operator, located in a convenient position either beneath the stage with a porthole for the operator or on either side of the stage. It is comparatively small and, therefore, can be located to the best advantage.

2.—The actual control equipment comprising the reactors, wiring troughs, magazine panels, Thyratron tubes, and wiring

Equipment Exhibits at S. M. P. E. Convention

Herman A. DeVry Corp.—Portable 16 mm. sound projector. A 16 mm. projector of theatre proportions, employing a sprocket intermittent and silent chain drive. A new type reel, non-smashable, made of flexible steel.

Ampro Corp.—Model J 16 mm. silent projector. Model KD 16 mm. silent projector. Model R projector, made expressly for later conversion to sound. Model K 16 mm. sound projector in compact case, equipped with special 48-minute reels. Active demonstration of new automatic repeating motion picture projector.

Griswold Machine Works—Junior splicer for 16 mm. film. Model R2, for 35 mm. film. Model T splicer for 35 mm. film equipped with reflector lamp.

Brenkert Light Projection Co.—Exhibit of Suprex high intensity lamps.

International Projector Corp.—Type SP (professional model) Simplex sound projector.

Radio Corp of America—Photophone projector fully equipped with high fidelity sound reproduction equipment. Sundry pieces of apparatus used in installation. Portable projectors (35 mm.) equipped with high fidelity apparatus. Optical reduction printer, to make 16 mm. prints from 35 mm. negatives.

Robin Imperial Generator Co.—The new Robin Stedy-Power generator.

Neumade Products Corp.—Display of the Beauty spot, with and without colorwheel attachment.

Hertner Electric Co.—Type HI 60-volt Transverter (motor-generator).

General Electric Co.—Copper-oxide rectifier, for motion picture projection lamps using Suprex carbons.

Forest Manufacturing Corp.—Model LD-30 copper oxide rectifier.

Holmes Projector Co.—Exhibit of 16 mm. sound projectors.

Universal Electric Welding Co.—Demonstration of wire-welded reels.

Victor Animatagraph Co.—Showing of 16 mm. sound projectors.

Electric-Acoustic Products Company—Exhibit and demonstration of the Illustralux Senior-16, Senior-12, and Junior. Device for projecting stills printed on motion picture film, with electrical pick-up sound-on-disk apparatus for concurrent narrative; for use by salesmen, etc.

terminals. These items are quite bulky, but can be set in less valuable space.

The screen brightness symposium, sponsored by the committee of that name, tied-in neatly practically all factors which have a bearing on ultimate screen results. Following the report of the committee as a whole there were presented the findings and observations of several specialists who discussed the problem in terms of optics, print density, photometry, projector and screen brightness, visual functions, and theatre illumination.

Light Output Factors

For example, Alan A. Cook (Bausch & Lomb) pointed out that there were two fundamental factors that determined projector light output: (1) source brightness, and (2) the effective aperture of the optical system. Precise information on these points, he declared, would aid in the calculation of the number of lumens available. Methods of computation and results for typical projectors were given.

Photometric laws, units and terms were described by R. P. Teele (Bureau of Standards). His paper covered the measurement of candlepower, transmission, absorption and projection systems.

It will be the aim of the Screen Brightness Committee in the future to coordinate all of this information and thus decide on the most practicable method for determining correct screen brightness for various types of theatre auditoriums.

D. B. Judd (Bureau of Standards) laid particular emphasis on what he termed "anomalies of vision," and said that this factor must be considered in any intelligent discussion of color. Those having normal vision, he said, can distinguish between three types: light-dark, yellow-blue, and red-green. Light-dark is the most primitive form of discrimination, and red-green discrimination is the last acquired, said Mr. Judd, adding that many people are particularly deficient in the latter category.

Too Little Practical Data

Michael Leshing, director of projection laboratories for Fox-20th Century, came all the way from Hollywood to voice the criticism that film engineers are too much just that and too little practical men dealing with problems in a manner that can leave no room for misunderstanding on the part of the practical man. In support of his contention he cited his experience with the picture "Metropolitan," a print of which was made on the Coast at a level of 12 foot-candles. Arriving in New York, declared Leshing, he was mortified to find that he could get only 8 foot-candles in Radio City Music Hall.

The answer to this one is easy, of course—being merely a comparison between 20-foot studio projection rooms with diffusive screens and the Music Hall with a throw of almost 200 feet and entirely different conditions. However, the incident lent force to the remarks by Mr. Leshing.

Elimination of the splice noise in sound films was described by E. I. Sponable of Fox-20th Century. E. C. Wente (Bell Labs.) cited the contributions made by telephone technicians to sound pictures. N. Levinson (Warner Studios) discussed a new method for increased volume range of sound pictures. J. Frank, Jr., described the latest RCA Photophone sound equipment for theatres.

The Papers Program

Future issues of I. P. will contain in full or in part many of the aforementioned papers, the official convention list of which follows:

Use of Films in the U. S. Army; Major M. E. Gillette, U. S. Army.

Microphotographic Duplication in the Service of Science; W. Davis, Director, Science Service.

Some Technical Aspects of Photomicography; R. H. Draeger, U. S. Department of Agriculture.

The Scientific Application of Color to Films; H. Ketcham.

The Development and Use of Stereo Photography for Educational Purposes; Prof. C. Kennedy, Smith College.

Demonstration Film Illustrating Applications of Polarized Light in Motion Picture Photography; J. W. McFarlane, Eastman Kodak Company.

Further Studies in Motion Picture Theatre Design; B. Schlanger.

Intermittent Sprocket Dimensions; H. Griffin, International Projector Corp.

Demonstration of 16-Mm. Colored Motion Pictures with Synchronized Sound; H. H. Jones.

Report of Projection Screen Brightness Committee; C. Tuttle, *Chairman*.

Screen Brightness and the Visual Functions; E. M. Lowry, Eastman Kodak Company.

Photometry and Brightness Measurements; R. P. Teele, U. S. Bureau of Standards.

A Resume of Methods of Determining Screen Brightness; W. F. Little and A. T. Williams, Electrical Testing Laboratories.

An Experiment to Determine the Screen Brightness Requirements of the Public; B. O'Brien, University of Rochester, and C. Tuttle, Eastman Kodak Company.

Density Measurements of Release Prints; C. Tuttle, Eastman Kodak Company.

A Review of Projector and Screen Characteristics, and Their Effects Upon Screen Brightness; A. A. Cook, Bausch & Lomb Optical Company.

An Analysis of Theatre and Screen Illumination Data; S. K. Wolf, Erpi.

The Measurement and Specification of Color; K. S. Gibson, U. S. Bureau of Standards.

Color Blindness and Anomalies of Vision; D. B. Judd, U. S. Bureau of Standards.

Sixteen-Mm. Pictures in Natural Color with Third-Dimensional Effect, Using Kodachrome Film; R. C. Phillips.

Visual Tests of Cellulose Films and Their Reproductibility; S. E. Sheppard,

(*Continued on page* 28)

• *S. M. P. E. Notes* •

If the strictly non-theatrical aspects of S.M.P.E. convention programs continue to expand at their present rate, a separate section should be allotted thereto. Including all educational and 16 mm. material, of course.

* * *

Chicago and Rochester are the next convention cities, in the order named. Hollywood having been promised the Spring, 1937, meeting, the locations for Society conventions of the next two years are practically a secret.

* * *

Louis Krouse, asst. president of the I. A., lent charm, distinction and beauty (?) to the banquet doings. Other I. A. representatives were Thad Barrows, L. 182, Boston (a town somewhere in New England); Messrs. Price and Young, L. 160, Cleveland; Joe Engel, L. 640, Long Island; W. Hartman, L. 388, Youngstown, and Messrs. Ormes, Ricks, Reed and Busch, L. 224, Washington.

* * *

P. A. McGuire (need we specify his association with International Projector Corp.?) persistently reminded the engineers that nuthin' means nuthin' until the film reaches the projection room and there is projected onto the screen before the cash customers. This is one matter upon which the engineers have done practically no research.

* * *

Representing the lamp manufacturers were Mrs. Mary Ashcraft, Karl Brenkert, J. E. McAuley and Don McRae. The supply men present included Walter Green, president of National Theatre Supply, branches of which were represented by Harry Blumberg and Charley Treen (Philly), and N. C. Haefele (Baltimore).

* * *

Herbert Griffin explained very patiently the switch of his company, International Projector Corp., from the new sprocket dimension of .0945, eminently correct as a standard, to the old style .0935 sprocket. It seems, according to Mr. Griffin, that the field wants not that which is right but that which it wants, wrong or right.

* * *

James R. Cameron and Joe Cifre, a couple more New Englanders, claim to have attended the convention. Having registered, the conclusion is that they attended through remote control.

* * *

One sight worth the watching was the presentation to Thomas Armat of honorary membership in the Society. Armat's contribution to the modern projector was detailed in I. P. for August and September, this year.

* * *

If one-half the technical advances detailed by Will H. Hays in his banquet speech happen in twice the time limit he set therefor, this business of projection promises to be highly interesting—and not a little involved.

Some Operating Characteristics Of the Suprex Carbon Arc

By CLARENCE S. ASHCRAFT

This highly interesting summary of the development of the carbon arc toward the present high-intensity Suprex type is replete with valuable operating data relating to maximum arc efficiency.

This article, like all signed contributions, reflects the opinions of the author and not necessarily those of this publication.

OF ALL the appliances pertaining to motion picture projection, none have improved as rapidly or changed as drastically as the carbon arc. As recently as 1923 there were still many of the old vertical carbon arcs in use. Since then the so-called low-intensity lamps have come and, it appears, will soon be gone. High-intensity has had a widespread use, in various forms, in the larger theatres. With each new development it has been thought the ultimate had been attained in brilliant, efficient projection.

Within the past two years a radical improvement in light sources, known as "Suprex," has been developed and put into general use. This name is not applicable to any particular carbon or any specific type of arc lamp but relates to the phenomenon occurring in and around the arc itself. Each type of arc or carbon has certain very definite and distinguishing characteristics.

The purpose of this article is to compare the Suprex with the ordinary high-intensity arc by (1) explaining the difference in the control of the gas emission from the positive carbon in each case; (2) showing why a more uniform field of light is produced by the Suprex arc, and (3) showing why the Suprex arc produces a greater amount of light per ampere than the ordinary high-intensity arc. Certain high-intensity patent references are included to chart the course of this type arc to date, as are various optical systems which provide an interesting contrast with modern practice.

The ordinary carbon arc will be disregarded in this article. So far as this writer is aware, no treatise has been presented wherein a high-intensity arc has been described and discussed with the view of instructing the projectionist how to operate it to obtain the best results. The production and flow of the incandescent gases are essential considerations in this regard, and too much stress has been placed on the point of proper arc voltage. The arc voltage will adjust itself once the proper current and arc gap have been set.

While high-intensity projection has had its proper place in the larger theatres, its application to medium-sized theatres has worked a hardship on the theatre owners, due to the comparatively large power and carbon cost. To this must be added the maintenance cost which is high due to the proximity of active operating parts to a high-powered arc.

The Suprex arc has provided these theatres with an arc that will not only relieve them of this expense but at the same time provide them with much better projection. The large theatres, however, will benefit the most by adoption of the Suprex arc, as they have been operating the highest-powered arcs over long daily time periods. It is marvelous that these high powered arcs can and are being replaced by the low-amperage Suprex arc, with a marked improvement in screen illumination.

The smallest theatres can also benefit by the adoption of Suprex for the reason that heretofore their only choice, for economical reasons, was the low-intensity arc. Their projection was of a very low grade, but the adoption of high-intensity projection was prohibited by greatly increased operating and maintenance expense. These theatres are now enabled to project pictures equal in brilliancy to that of the larger metropolitan theatres, at a low operating and maintenance cost.

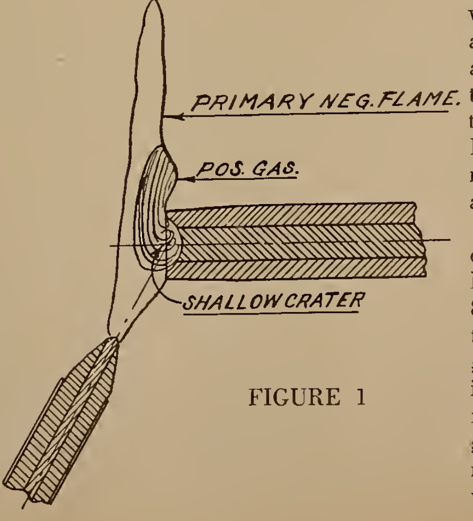


FIGURE 1

Concrete examples of the extreme efficiency of the Suprex projection system are found today in the largest theatres where high-intensity lamps have been used for years, using currents as high as 135-140 amperes. Through the use of the Suprex arc, it is now possible to increase the brilliancy of the picture in these houses with less than one-half the current. The efficiency of various high-intensity arcs varies to a great extent, of course, depending upon the optical systems used, which units will be discussed subsequently.

One of the outstanding advantages of the Suprex arc, when a proper optical system is used, is that the field or uniform distribution of light over the entire area of the screen is very much improved over that obtainable with high-intensity arcs, a characteristic of which is to produce a brilliant spot in the center of the screen that fades gradually towards the sides. An average illumination reading of high-intensity screen light is 30-50-30 (side-center-side).

Credit for the invention and development of high-intensity unquestionably belongs to Heinrich Beck, as is disclosed in Patent Office records. In 1912 Beck described a high-intensity arc wherein he was able to increase the brilliancy of an arc 300% over the then ordinary carbon arc by the use of highly-loaded electrodes containing light-emitting admixtures such as metallic salts or carbides. He specified that a carbon of 13 mm. diameter should operate at a current of 120 amperes.

All the conditions present in the modern high-intensity arc are described by Beck in his Patent No. 1,029,787 of June 8, 1912, except that, due to his failure to place the negative electrode at an angle to the positive, he had great difficulty in maintaining the current at the crater face. However, by the use of indifferent gas such as coal gas, alcohol, etc., surrounding the arc, he was able to prevent the current from emerging from

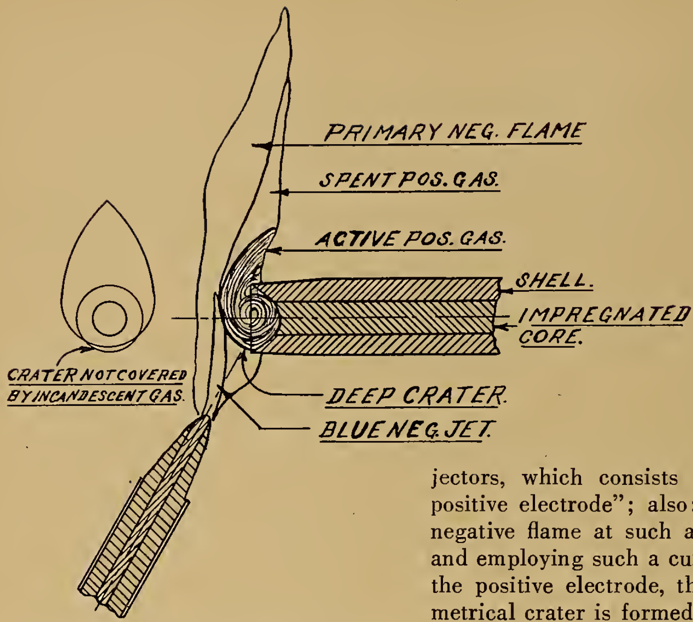


FIGURE 2

the exterior of the positive electrode to the rear of the crater face.

In 1914 Beck was granted Patent No. 1,086,311 in which he describes a high-intensity arc with the electrodes at an angle to each other, he having found that for practical purposes coaxial carbons did not produce the desired effect. In this later patent Beck covered the high-powered arc of modern times in which the negative flame contained a jet or tongue in the center. This tongue was deflected from the center of the positive crater in such a manner that the mass of incandescent gas would be maintained with the crater itself, producing a very brilliant light source.

After Beck discovered, perfected, and patented the high-intensity arc, Elmer A. Sperry was granted Patent No. 1,227,210 on a high-intensity arc the operation of which was identical to that described by Beck in 1912. The Beck patent, June 8, 1912, page 2, line 41, states: "It has been found preferable for obtaining steady burning to slowly rotate the positive carbon."

The Sperry patent claimed: "The method of operating flaming arc electrodes of carbon allows material for projectors, which consists in rotating the positive electrode"; also: "Directing the negative flame at such an angle thereto and employing such a current density, in the positive electrode, that a deep symmetrical crater is formed therein."

Beck, 1914, (in Fig. 4 of his patent) shows a deep symmetrical crater with the negative positioned at an angle to the positive. Beck, 1912, stated: "The crater, prevented from spreading laterally, bores its way into the carbon." Beck employs a current density of 120 amperes in a 13 mm. carbon, which suffices to form a satisfactory crater.

This writer considers that Sperry added nothing to the art; his patent application merely related in different wording the phenomenon Beck had discovered. A digest of the Sperry patents discloses that Beck was cited at every turn. Sperry admitted that "the results desired cannot be obtained with the electrodes coaxial." This has an important bearing on the appended explanation.

Sperry's failure to produce satisfactory results with the electrodes coaxial was due to a superabundance of gas which was caused to issue from the crater. The force of this gas was uncontrollable, its high pressure being due to high arc voltage, the result being the same as if two streams from high-pressure hoses would meet. The one would naturally over-ride the other.

Beck's failure was due to the fact that excessive pressure of the negative flame and insufficient positive gas pressure caused the predominating force of the negative flame to break through any positive gas barrier set up around the crater. This can be likened to a stream from a powerful hose being played on a stream from a garden hose, the pressure from the former predominating and causing a flow of water back of the nozzle of the latter.

In contrast to these two unsuccessful attempts to operate the electrodes coaxially, the Ashcraft patent[1] describes a successful method of accomplishing this object with excellent results.

[1] U. S. No. 1,983,430.

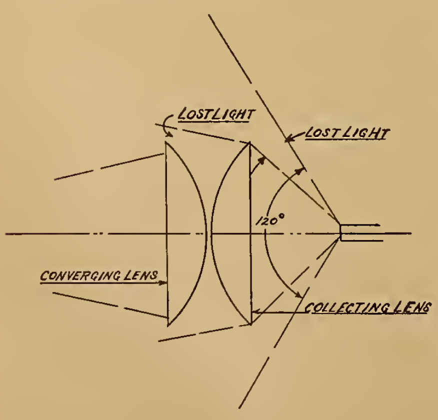


FIGURE 3

High-intensity projection, as first practiced, did not utilize the extreme current densities that were used in later years. Until 1926 the currents were quite normal and resulted in subnormal screen results. The arc of that period is shown in Fig. 1.

It will be noted that in this arc substantially only two flames are present, the primary negative and the positive gas emission. No jet is produced in the negative flame, as was described by Beck. The negative flame is also positioned in advance of the end of the positive electrode. This fact is in contrast to the following description of the high-pressure, high-intensity arc.

In operating the high-pressure, high-intensity arc, the positive crater is carried further forward—in fact, the crater end extends into the negative flame approximately 1/8". The center jet of the negative flame sweeps past the crater mouth but does not enter therein. The length of an arc operating at 130 amperes is 7/8", whereby the arc voltage will approximate 68. The visible negative jet does not appear in the negative flame until a current of approximately 100 amperes is reached.

If the positive crater is carried too far to the rear of the upward sweep of the negative flame, a distinct unsteadiness of the arc will exist, causing flickering of the light. If it is carried too far forward, there will be a current emission from the exterior of the positive electrode, causing a loss of light upon the screen (Fig. 2).

Currents beyond 135 amperes used with the 13.6 mm. positive carbon are excessive and tend to rapidly increase the consumption of the electrode and damage the lamp mechanism. This seems to be the limit of the 13.6 mm. carbon, as beyond this point an excessive tail flame develops and prevents good projection by causing extreme unsteadiness of the screen light.

Rather than attempt to increase the current beyond reasonable limits, it is much better to improve the optical system. The ordinary and least efficient of these systems is the double plano-convex system shown in Fig. 3.

This combination usually has a con-

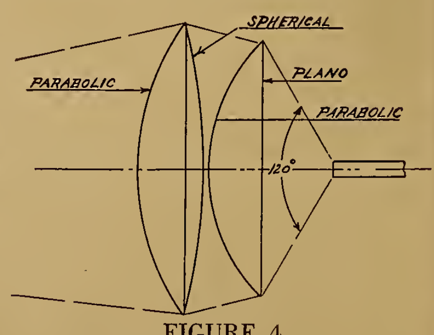


FIGURE 4

Sphero-parabolic condenser

denser diameter of 4½" and a focal length of 6" for the collective, and 9" for the converging, lens. Little better is the plano-convex system which utilizes a 4½" x 6" collector and a 5" x 8" or 9" converging lens.

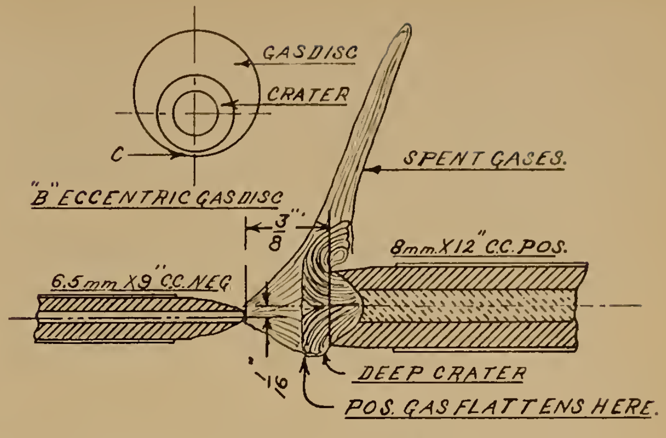
A major optical company introduced a few years ago a system of condensers having on the rear of the collecting lens a cylindrical curvature which was said to give an aperture spot greater in width than in length. The collecting lens was of 5½" diameter, and the converging lens of 6" diameter. An increase in light undoubtedly was obtained through the use of the larger diameter combination, but the efficiency of the combination still was low. Not until the introduction of the sphero-parabolic condensers of large diameter was the maximum efficiency of high-intensity optical systems realized. This combination is shown in Fig. 4.

The collecting lens in this combination was of a 6⅜" diameter plano on the rear and parabolic on the front surface. The collector was of 7⅜" diameter, spherical on the rear and parabolic on the front surface. The arc was set within 3⅝" of the rear surface of the collecting lens, thereby having a great angle of pickup.

This condenser system has proved most efficient. Other types have been used, such as the cylindrical-parabolic-meniscus combination. The drawback to this system is the extreme thickness of glass in the front factor. As a rule, this system has only 80% of the efficiency of the sphero-parabolic combination. Although large size condensers provide an increase in illumination, there is a greater tendency toward screen discolorization attendant upon their use.

In some cases where high-intensity is used it is essential, due to extreme heat, that Pyrex glass be used in condensers and reflectors. However, its full use is detrimental to good projection, since a yellowish cast is given the light which, in the case of reflectors, is not as pronounced as in condensers having a greater thickness of glass through which the light must penetrate. Currents beyond 75 amperes in so-called hi-low lamps necessitate the use of Pyrex reflectors; while currents beyond 115 amperes in high-intensity, condenser-type lamps require that the rear, or collecting, lens be of Pyrex.

FIGURE 6



IDEAL SUPREX ARC AT 64 AMPS.
ARC VOLTS 37—WITH MAGNETIC FIELD.

The Suprex Arc

A detailed description of the Suprex arc and flow of gases will enable the projectionist to obtain maximum efficiency from the arc. Suprex is the method of producing a quantity of luminescent gas, so positioning the electrodes and balancing the currents as to produce a flattening of the gas from the positive crater in front of the crater itself.

From Fig. 6 it is apparent that the control of the gas emission from the positive crater is far different from that used in high-intensity. In the Ashcraft Suprex arc the escape of the gas is from the center of the positive crater outward in all directions. As it escapes from the mouth of the crater, the pressure of the negative flame flattens it into a disc-like shape. In high-intensity operation every effort is made to cause the complete escape of gas from the upper portion of the crater (see Fig. 2).

By causing the gas emission to be flattened or mushroomed, it is obvious that every part of the crater will be heated to the same temperature. Also, this same condition occasions an equal consumption at all points of the periphery of the crater, resulting in a straight crater face at all times.

In the high-intensity arc the escape of gas from the upper portion of the crater heats that section to a higher temperature than the lower part. The projected image of a crater area upon a screen can be no more uniform in illumination than the crater is uniform in heat intensity. For this reason the projected light from high-intensity arcs is, in most cases, discolored and varies in intensity.

Obviously, the Suprex system provides a light source of near-perfect uniformity, and provided the proper optical system is used, the projected light will be uniform upon the screen.

Proper Carbon Sizes

Currents of 43-50 amperes can be used with the 7- and 6-mm. combination: but in excess of 50 amperes the 8- and 6-mm. combination is best, on up to 56 amperes. For 56-60 amperes the 8- and 6½-mm. trim is best; while for 64-66 amperes the 8- and 7-mm. trim will give best results.

Due to the inherently low voltage of the Suprex arc, the accumulation of carbide upon the negative tip is not unusual. This carbide is generated in the positive gas emission, and being of an exceedingly high temperature, it leaves the crater and flows over the negative tip, condensing in the form of liquid carbide (Fig. 8). A continued low voltage arc with too large a negative electrode will result in an excess amount of liquid carbide, causing flickering and displacement of the negative flame.

The remedy for this condition is the use of a negative carbon of as small a diameter as possible, in order to main-

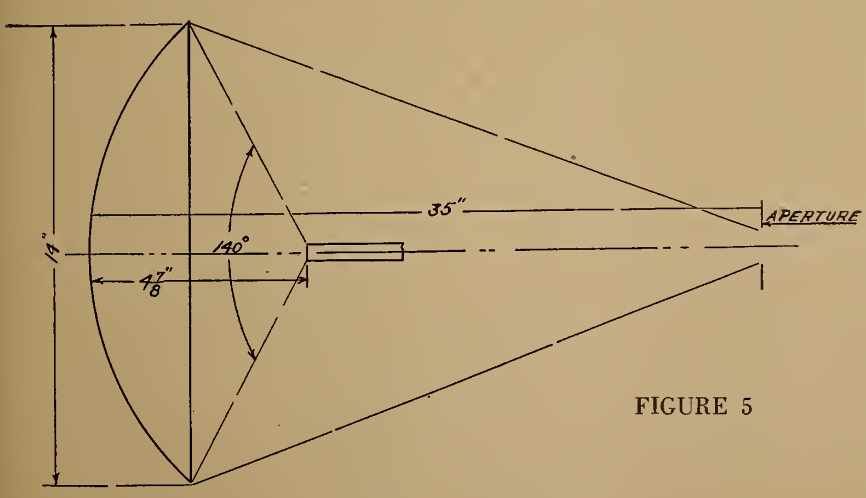


FIGURE 5

High-magnification elliptical reflector

tain a high tip temperature, so that condensation of carbide is not allowed to boil and bubble on the tip of the negative. Not only is the stability of the arc impaired by this carbide, but upon extinguishing the arc there will be left a button of red carbide which is an insulator and hinders reestablishment of the arc. If the arc is reestablished without removing this bead, the carbide will ignite and explode, causing serious pitting of the mirror.

The maximum capacity of any carbon is determined by the rate of consumption. It is obviously impractical to impress upon a 12-inch carbon a current which consumes in excess of 5″ during the running of a double reel of film. Since there is a minimum waste of 2″ to each carbon, leaving only 10″ of usable length, consumption in excess of 5″ would mean the use of one carbon per reel, with resultant large waste.

The normal maximum consumption of carbon, where a brilliant picture is desired, will be 4″ per 20 minutes of positive carbon, which rate will insure sufficient carbon for the running of two double- and one single reels. Where maximum brilliancy is not desired, three double reels may be run with a single carbon. A rate of consumption below 4½″ per 20 minutes is uneconomical, the resultant increase in brilliancy small.

For many years arc manufacturers have utilized the influence of the magnetic field upon the arc. Its use with the Suprex arc is not absolutely essential but is beneficial in that it reduces the fluctuation of the arc to a minimum. It will be noticed that in the Suprex arc (Fig. 7) there is a tendency for the crater gas to curl under the carbon at the point designated. When this luminescent gas touches the electrode there occurs a passage of current at the point of contact that will displace some of the crater current. This action, from time to time, causes an unsteady arc.

By placing the arc in a properly polarized magnetic field, the distribution o the gas is in no way altered, but the ring of incandescent gas surrounding the crater is displaced from a practically concentric position as shown at A in Fig. 7, to an eccentric position as shown at B in Fig. 6, where the lower edge of the gas disc is substantially tangent at point C to the periphery of the crater.

Curiously, if the arc is established with the magnetic field in operation, the flame operates in a very normal manner; but if established in the magnetic field and then removed, the arc at once becomes very erratic and does not assume a normal position for some time. An illustration of magnetic influence is given, showing two burning conditions.

Fig. 6 shows the shifting of the flattened gas under the influence of the magnetic field. Fig. 7 indicates the normal arc without the magnetic field.

Several types of magnets are used. The permanent magnet's effect is not uniform and its continued correcting effect doubtful. The series-coil magnet composed of several turns of one of the arc current conductors around an armature is also used, but its influence or strength is dependent upon the arc current and thus is variable and inconstant.

Preferred by this writer is the shunt-coil or voltage-type wound with several hundred turns of fine wire and so adjusted as to at all times produce such a magnetic field as to react properly on the arc. By providing the correct number of turns of the proper size wire, exact arc correction is obtained. The magnetic coils are usually placed to the rear of the large reflector away from the heat.

Suprex Optical Systems

In selecting a proper optical system for Suprex arcs it must be remembered that not only is the light source very much smaller than with high-intensity carbons, but the angle of light distribution is greater. That is, the light emanations from the crater are not confined in the same arc or number of degrees as in high-intensity.

To compensate for the condition of smaller light source, the magnification of the reflector must be increased in order that the projected spot will be sufficiently large to adequately cover the film aperture. An average must also be struck between the possible diameter of the reflector and the distance from the reflector at which the arc is to operate. Obviously the arc must be maintained at a greater distance from the glass reflector than in low-intensity work, due to the increase in arc temperature and the tendency of the arc to throw off particles of matter which pit the reflector.

It is mechanically difficult, at present, to use a reflector in excess of 14″, therefore, in order to collect the entire 140 degrees of the light from the arc, the arc will be placed approximately 5″ from the reflector. The use of a smaller reflector with the arc this distance from it would make the lamp most inefficient.

The latest practice is to guide the ends of the electrodes by means of supports placed near the arcing tips. By this means the crater is at all times held in the optical center of the reflector, and the tip of the negative carbon is maintained in the correct position relative to the positive in order to maintain a straight crater face without hand adjustments. Regarding the latter, however, it is essential that the guide for the tip of the negative be provided with adjustments for both vertical and lateral positioning relative to the center of the positive crater.

It will be found that the higher the current used, the lower must be the relative position of the negative. For instance, a certain size carbon may burn with a straight crater face with the carbons practically center to center at 42 amperes; but as the current is increased to 50 amperes, it will be found that the tip of the negative carbon must be placed 1/16″ below center to maintain the crater face at right angles to the axis of the positive electrode.

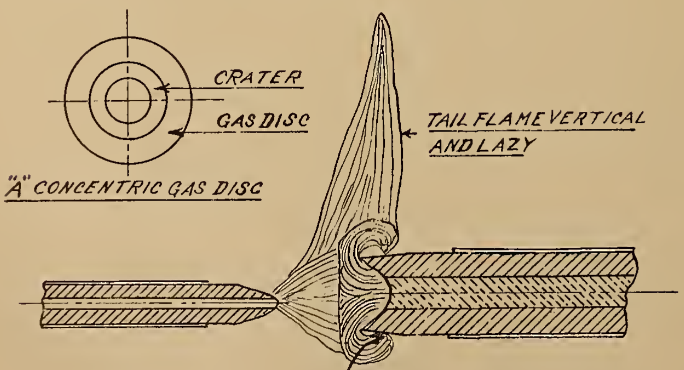


FIGURE 7

SUPREX ARC WITHOUT MAGNETIC FIELD

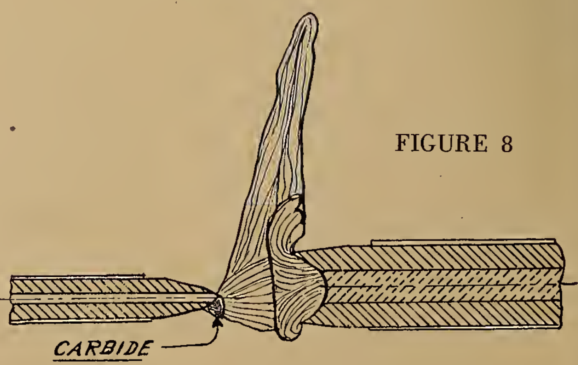


FIGURE 8

EFFECT OF CARBIDE BEAD ON NEGATIVE TIP

Step-By-Step Analysis of Sound Reproducing Equipment

By AARON NADELL

XV. Western Electric 6000-A Rectifier

THE apparatus described in this article is diagrammed as three separate units, each of which is mounted on its own panel, all three panels being installed and inter-connected on a single rack. The result is a neat assembly classified as a single unit, the 6,000-A rectifier. The component parts are the 520-A rectifier panel, the 519-A filter and potentiometer panel, and the 521-A filament supply panel.

This assembly provides plate power to the W.E. 8-B and 10-A amplifiers, and a.c. filament supply, at the proper voltage, to the latter amplifier. The filament supply of the 8-B is d.c., and derived from a separate rectifier, or from storage batteries or a motor-generator.

The 521-A a.c. filament supply panel is diagrammed here as Fig. 1. It consists of an on-off switch, a step-down transformer, a tap strap arrangement to suit the transformer input to the line voltage, and a double rheostat.

The input to Fig. 1 is at the extreme left of the drawing, represented by terminals about two inches apart, and indicated by vertical arrows labelled "110V, 220V." Directly to the right of these terminals is a double-pole, single-throw switch labelled "D," which is the on-off switch of this unit. In normal operation this particular switch is seldom used, being left on at all times, and power supply is controlled by the master a. c. line switch. Many projectionists, however, have the habit of throwing this switch "D" with the others, discussed hereafter, that are also mounted on the 6,000-A assembly.

To the left of the switch are two fuses, and through these the a. c. line runs to the two rheostats, M and N. These are operated simultaneously by the same wheel-like dial on the front of the panel. The sliding contact operates to "short" out any desired portions of the rheostats. This method of connection insures against open circuit in case of dirty or imperfect contact.

The step-down transformer is shown to the left of the rheostats. The primary consists of two equal portions. These two windings may be connected either in series or in parallel, according to the line voltage used. With 110-volt lines, terminal 1 is strapped to 2, and terminal 3 to 4. These connections effectively wire the bottom of the upper primary to the bottom of the lower primary, and also tie the tops of the two primaries together, placing both coils in parallel.

With 220-volt lines terminals 2 and 3 are strapped together, 1-2 and 3-4 being left as shown in the drawing. This connection places both primary coils in series, doubling the effective number of primary turns. The greater the number of turns in the primary, of course, the lower will be the voltage generated in the secondary. Doubling the number of primary turns at the same time that the primary voltage is also doubled, leaves the secondary voltage unaltered.

Fig. 1 can therefore be used with either 110- or 220-volt lines as desired, merely by changing these strap connections—and (if desired) changing the fuses in accord with the difference in primary current.

The output of the transformer is tapped for either 14 or 12 volts, and connection may be made to either set of taps, according to whether the line voltage is high or low. In practice these connections are not changed to accommodate changes in line regulation, but are chosen permanently according to average line conditions.

The output terminals at the right of Fig. 1 (either the 14-volt pair or the 12-volt pair) are wired to the filaments of the 10-A amplifier, which require 10 volts at 3 amperes each, or a total of 12 amperes. The filament current can be regulated by means of the double rheostat, M and N, shown in Fig. 1, which is adjusted in accordance with a filament voltmeter mounted on the amplifier.

The 10-A amplifier is commonly placed on the same rack with the apparatus of Figures 1, 2 and 3, the four pieces of apparatus constituting a single assembly.

The Circuits of Fig. 2

Fig. 2 represents that part of the 6,000-A rectifier that supplies plate power to the tubes of the 10-A amplifier. It provides 750 volts, d. c. at approximately 240 amperes, or 60 amperes plate current for each of the four tubes in the amplifier. In W. E. wide range systems the output of Fig. 2 is increased to 1,000 volts, approximately. The double rheostat, A-B, shown toward the bottom of Fig. 2, provides control over the output voltage of this rectifier.

The rectifier tubes, V-1 and V-2, are the two-electrode tubes shown in the lower right-hand corner of the drawing. Mercury vapor tubes are now almost invariably substituted. At least two minor circuit modifications are available which, when applied to Fig. 2, make possible the use of mercury vapor rectifiers in place of the W. E. 219 tubes, V-1 and V-2, shown in that drawing.

The input to Fig. 2 is shown at the lower left-hand corner drawing, and may be either 110- or 220 volts a. c. Both sides of the line are fused. A safety switch, operating whenever the rear

FIGURE 1

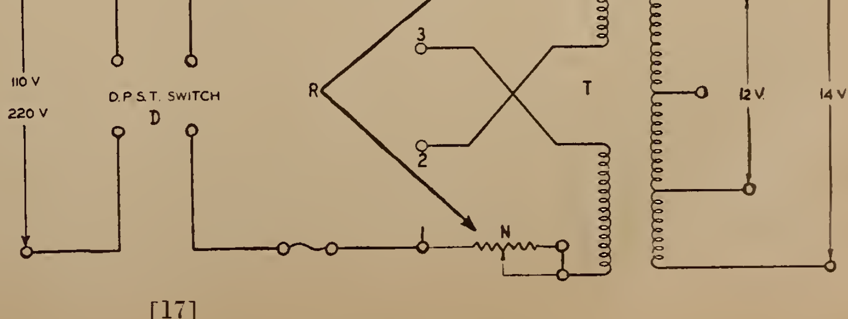
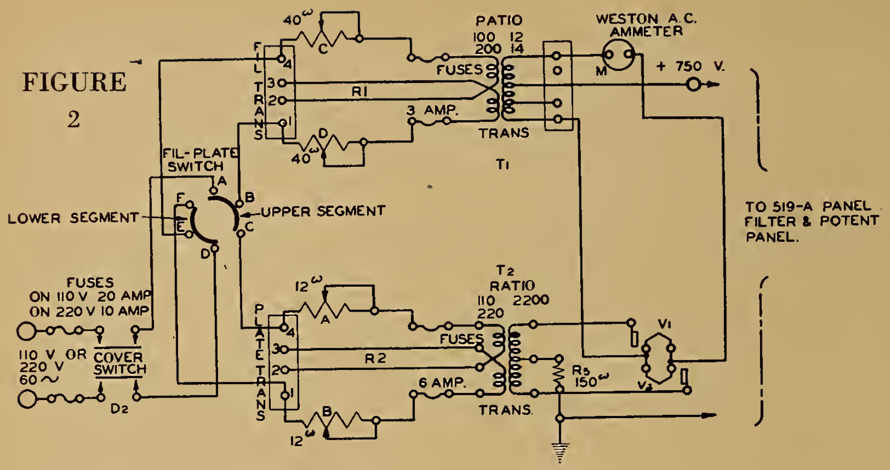


FIGURE 2



cover of the panel is removed, opens both sides of the line.

From the cover switch (D-2) the upper input wire runs to Terminal A of the power switch. The lower input wire runs right and upward to Terminal D of the same switch, which is a rotary, three-position switch, carrying on its face a dial marked "Off," "Fil," and "Plate." As drawn in Fig. 2, the position of the switch shows the word "Plate" through the opening in the switch cover. With the switch in "off" position, however, all six contacts are open-circuited.

Assuming the switch to be in "off" position, the first turn closes Terminal A to B, and Terminal D to E. The upper wire of the power input circuit is thus connected to Terminal 1 of the filament transformer, at the top of the drawing. The lower wire of the power input circuit is connected, through switch Terminals D and E, to Terminal 4 of the same transformer.

As shown, the primary of that transformer is open-circuited at its own terminal strip. With 110 volts input Terminal 1 would be strapped to 2, and Terminal 3 to 4, placing the two primary coils in parallel. With 220-volt circuits those coils would be strapped in series by joining Terminals 2 and 3. The arrangements are identical with those already explained in the case of the transformer of Fig. 1.

From this terminal strip the circuit leads through the double rheostat, C-D, both contacts of which operate by means of a single wheel-like control mounted on the face of the panel. Thence through the two three-ampere fuses, and to the transformer primary.

The secondary of the transformer is provided with a tap at or about the midpoint of the winding, to provide a return for the rectified current. It is also tapped for either 12- or 14 volts output, either of which may be used, according to whether line voltage is generally high or low. These tap connections are changed in course of operation, but once set, correction for varying line conditions may be made by means of a rheostat, C-D. In the drawing, connection is made to the 14-volt tap.

From the bottom terminal of this secondary the circuit runs down and right to the filaments of the two tubes. From the right-hand side of those filaments it returns right, up, left, up, left through the a. c. ammeter, and back to the top of the transformer secondary. This ammeter normally reads 12, 6 amperes being the required filament current for each tube.

The circuits just traced are operative when the Fil-Plate switch has been thrown to connect A with B and D with E, showing the word "Fil" through the opening in the switch cover. When the switch is again twisted, A is joined not only to B but to both B and C, as shown in the drawing, and D is connected to both E and F, and the word "Plate" shows through the opening in the switch cover.

The circuits thus far traced are not interfered with in any way, but this switching connects Terminal 4 of the plate transformer to the upper side of the power line, in parallel with Terminal 1 of the filament transformer. Terminal 1 of the plate transformer is joined to the lower side of the power line, at D, in parallel with filament transformer Terminal 4.

The primary circuit of this plate transformer, T-2, is identical with the primary circuit of the filament transformer already traced, except that the rheostats have different values, being 12 ohms per winding instead of 40 ohms per winding. Six-ampere fuses are used instead of three-ampere fuses, and of course the construction of the transformer itself is entirely different. The filament transformer uses high primary voltage at low current, stepping down to low secondary voltage at high current. The plate transformer uses the same primary voltage at somewhat greater current, but the secondary voltage is stepped up, and not down, varying from 1000 to 1500 volts, with current equal to one-quarter ampere.

The secondary of the plate transformer is also center-tapped, the mid-tap connecting to ground through resistor R-5. The drawing is deceptive at this point, apparently indicating that the plate of V-2 is grounded. This is not the case, as the wire from R-5 to ground is not intended to touch the plate wire of V-2.

The circuit of the plate secondary varies somewhat with each change in its alternating polarity. Considering a moment when the plate of V-1 is positive, that circuit is as follows: electrons from the filament of V-1 are attracted to the plate of the same tube, thence (tracing around from negative to positive) to the upper end of the plate secondary, thence through the center-tap and the R-5, 150-ohm resistor and right through the arrowhead to the external load (the plates of the 10A amplifier). Returning through the upper arrowhead at the top right of the drawing, which is marked +750 V., the circuit continues to the center-tap of the filament secondary. Thence the electrons continue, through that secondary and through the filament wires to the filament from which they came. At this time the plate of V-2 is negative, and the vacuum of that tube an open switch.

During the next reversal of a. c. polarity the open switch appears in the vacuum of V-1; and the plate of V-2, having become positive, attracts filament electrons. The circuit then continues through V-2 plate and the lower end of the plate secondary to the center tap and the 150-ohm resistor, continuing

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through the external load and returning to filament as before. Current therefore flows through the external load during both halves of the a. c. cycle, and always in the same direction. The external load is therefore provided with d. c. That current, however, is somewhat unsteady.

Consider a moment when the a. c. polarity is in the act of reversing, and the plates of both tubes are neutral, neither being positive or negative; at that moment both vacuums are open switches, and no current at all flows to the external load.

As one plate or the other becomes more positive, its attraction for filament electrons increases, and consequently the current supplied to the external load increases. At the end of the 1-240th of a second that plate has become as positive as it ever will be, and its potential begins to decline. The external load has received a pulse of maximum current, and that current is now decreasing.

No amplifier can operate with so irregular a plate supply. The function of the unit shown in Fig. 3 is to iron out those irregularities and present to the amplifier a current that not only flows always in the same direction but is always of the same amperage.

Consequently, the two arrowheads at the top right and bottom right of Fig. 2 are not wired directly to the external load (the amplifier) but through the 519-A filter panel, Fig. 3. They connect to the binding posts marked "+750 V." and "—750 V. G" at the left-hand side of Fig. 3. The "G," of course, stands for ground, the ground connection of the plate supply negative being shown in Fig. 2 just under the 150-ohm resistor.

The Circuits of Fig. 3

Fig. 3, the 519-A panel, contains more than a filter. It includes, in addition, a voltage divider, by means of which the 750 volts d. c. drawn from Fig. 2 is split into three voltages, providing not only 750 volts for each of the four tubes in the 10-A amplifier, but 350 volts for two of the tubes, and 130 volts for the first tube, of the 8-B amplifier. In addition, Fig. 3 contains a switch for cutting off voltage from the 10-A and allowing current to flow through a substitute load instead, and a three-scale voltmeter complete with multiplier and its switch.

Both the front and the back covers of Fig. 3 can be removed, and each is equipped with a cut-out switch that open-circuits the positive side of the high-voltage line. These are switches D-6 and D-5, shown at the right of Fig. 3. They do not provide complete protection, since high voltage is stored in the two condenser banks, C1 to C24, and C25 to C42. Each of these condensers is 1 microfarad in value, and the charge stored in 42 microfarads at 750 volts can throw a strong man off his feet. Those condensers should be short-circuited with a well-insulated screw-driver to draw off the charge before any work is done on the circuit.

The two banks of condensers together with the reactance, L-1, constitute the filter. When the current through the reactance declines, a reinforcing current is created by the corresponding decrease in the strength of the magnetic field surrounding the coil. Energy is taken from the field to create additional current. When the current from Fig. 2 tends to rise, part of the increase is used up in creating a stronger field, energy being taken from the wire in the form of magnetic force. Thus the presence of the reactance tends to keep the current through the circuit constant in spite of variations in the source.

The charge the condensers can hold depends upon the voltage impressed across them. When that voltage rises, additional current is forced into the condensers and thus shunted away from the amplifiers. When the source voltage declines, the condensers can no longer hold their full charge of electricity, but act like sources of voltage, causing current to flow through the load circuit.

During those moments when both plates in Fig. 2 are neutral, and Fig. 2 supplies no current to Fig. 3, the amplifiers receive their usual supply from the discharging condensers and from the effect of the collapsing magnetic field around L-1. During those moments when one of the plates of Fig. 2 is at peak positive charge, part of the peak current and voltage delivered to Fig. 3 goes on to the amplifiers, and part is absorbed in creating a stronger magnetic field around L-1 and in charging the condensers. Consequently, the current and voltage delivered to the amplifiers remain steady at all times.

The positive line of Fig. 3 may be traced right through the ammeter (which, under normal operating conditions, reads approximately .4 amperes—400 milliamperes) to switch D-3, and thence to the 750-volt positive output, which is wired to the 750-volt power input of the 10-A amplifier. The negative line can be traced similarly, right across the drawing, to the 750-volt negative output terminal in the lower right-hand corner, which is wired directly to the 750 negative power input of the same amplifier.

Just to the right of the ammeter, a potentiometer, P-1, bridges across this line. Obviously, a potential difference of 750 volts must exist across that winding. The slider can be moved as desired, until it rests at a point where 130 volts potential difference exists between the sliding contact and the negative end of the winding.

That potential difference will cause a proportionate current to flow down through switch D-1 to the 130-volt power input of the 8-B amplifier, through the vacuum of the first tube of that amplifier, and back in at the 750 negative terminal of Fig. 3. From the same slider we may also trace right and upward, left through a resistor, left through the voltmeter, and left and down to the negative bus of Fig. 3.

The same 130-volt potential difference will cause current to flow through the meter, and that current will move the meter needle. Since the current flowing, at 130 volts, will be strictly proportionate to the resistance of the meter and of its multiplier resistor

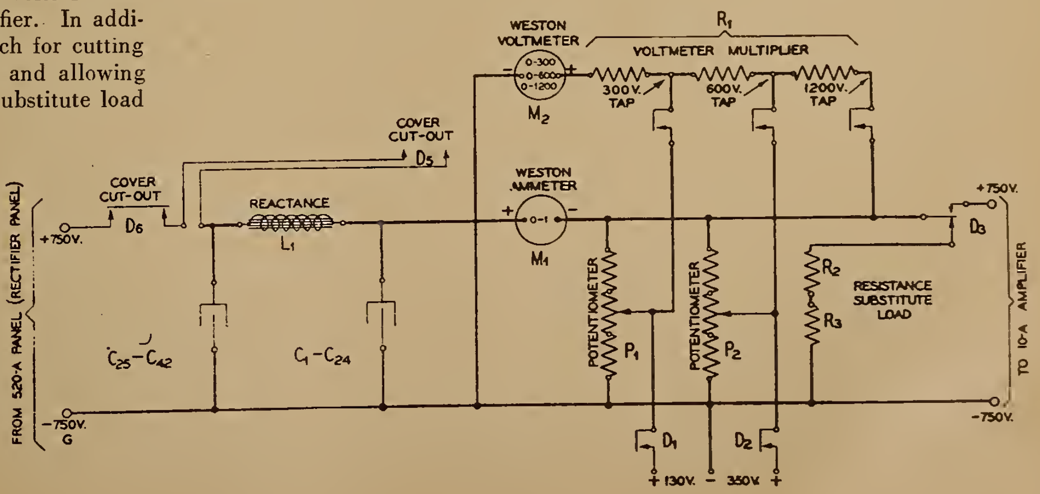


FIGURE 3

(Ohm's Law) the meter dial can be calibrated in volts and made to indicate the *potential difference* that drives current through it, rather than the current itself.

Just to the right of potentiometer P-1 is a similar potentiometer, P-2, through which 350 volts is tapped off to provide plate power for the second and third tubes of the 8-B amplifier. But if 350 volts were allowed to drive current through the same voltmeter and through the same resistor used before, the needle would either go off-scale, or the scale would have to be made so small that reading minor changes in voltage would be impractical. Therefore, a second multiplier is added in series to account for the increased voltage. The needle moves about the same distance as in the previous case; but since the 600-volt meter switch has been used, we read the 600-volt scale of the meter dial, instead of the scale previously read.

The same meter also shows a 1,200-volt scale, which is referred to when the right-hand multiplier switch is thrown in, to read the output to the 10-A.

Actually, the three multiplier switches shown in Fig. 3 are built as a single rotary switch having four positions: off (all three switches in Fig. 3 open); 300 volts (left-hand switch of Fig. 3 closed); 600 volts (left-hand switch of Fig. 3 open, center switch closed), and 1200 volts (only the right-hand multiplier switch closed).

Reviewing: the three resistors (R-1) shown along the top of Fig. 3 are voltmeter multipliers and carry only a minute portion of current at any time. The two potentiometers, P-1 and P-2, are voltage dividers by means of which 130 volts and 350 volts are supplied to the high-voltage circuits of the 8-B. The negative return may be tied into the 750-volt negative bus, but for convenience a second terminal is provided for the return from the 8-B located, in the drawing, midway between the 130-volt and 350-volt positive terminals at the bottom of the drawing. By means of D-1 and D-2 either of these circuits may be opened at will.

D-3, at the right-hand end of the positive line, serves to open the 750-volt circuit to the 10-A. However, the relatively high current (¼ ampere) requires that a dummy load be substituted. If this were not done, the line voltage would rise above 750 and place an excessive load on the plates of the 8-B and, also, possibly damage the filter condensers or the circuits of Fig. 2. Therefore, D-3 is not a single-pole, single-throw switch, like D-1 and D-2, but a double-throw rotary switch that has no "off" position. If it is not closed to the 10-A, it closes to R-2 and R-3, which provide a substitute current path.

SOUND PROJECTS OUTLINED BY S. M. P. E. COMMITTEE

A REPORT OF THE SOUND COMMITTEE

THE Sound Committee this year has decided to concentrate upon four projects, the first two of which will be discussed in some detail because the Committee will need the cooperation of every one if it is to accomplish anything on them.

The object of the first project is to achieve greater uniformity in the sound records from the various producers. Certainly, it will be agreed that that is necessary and desirable; but at once the question arises as to what is the proper or ideal recording characteristic. The Sound Committee three years ago recommended to the Standards Committee that the dividing line between recording and reproduction should be the release print—that all losses incurred up to the release print ". . . . should be compensated for in the recording operation. The frequency characteristic of the reproducing apparatus should be flat except for a correction for whatever slit is used."

This recommendation, however, has not been adopted as yet by the Standards Committee, and it is the sense of the Sound Committee that the recommendation should be reconsidered in the light of the developments and data accumulated during the past three years.

Before any conclusions can be reached on this point it seems necessary to obtain data on the recording frequency characteristics used at present by the various studios. This, in turn, raises the question of how to obtain comparative data from the various studios. It appeared from a discussion of the question that a great deal of skill, patience, and special calibrated precision equipment are required if satisfactory results are to be obtained.

To determine whether measurements made by different organizations would check, a frequency film was made and the same print was measured by five different organizations. When the results were plotted upon the same sheet of paper they revealed excessive deviations at frequencies higher than 3,000 cycles and smaller ones at frequencies lower than 200 cycles. Even the results from two of the most skilled research organizations in the country deviated by amounts that represented the limit in experimental error.

Frequency Reference Standard

It was decided, therefore, that a much simpler method of obtaining comparative data from the various studios would be to establish a "Frequency Reference Standard" in the form of a carefully prepared frequency film. In such a film the actual level that is recorded is of little importance. For comparative purposes it is necessary only that the various organizations concerned measure the reproduction from this Reference Standard upon any machine and any system that they may happen to be using; and then to measure, under identical conditions, a film record made by themselves, and to report the deviation from this Reference Standard.

If two organizations obtain the same deviation it is obvious that their recording characteristics will be the same; and if different, a comparison of the deviations will show the location and magnitude of the differences.

Such a film has been made for the Sound Committee through the courtesy of RCA Manufacturing Co., and the master negative is in the hands of the Chairman of this Committee. The No. 1 print has been designated the "Primary Frequency Reference Standard," and the Eastman Kodak Co. has kindly offered to measure its frequency characteristic once each year on their microdensitometer, to determine its stability as a reference standard.

It is planned to hold the number of prints made from the master negative to an absolute minimum. Each succeeding print made from the master negative, beginning with No. 2, will be designated a "Secondary Frequency Reference Standard," and a calibration will be provided with it which will show the deviation between it and the Primary Reference Standard. The secondary standards should not be used as test reels, but should be used only for the purpose of calibrating test reels.

At intervals indicated by experience,

(*Continued on page* 20)

FILM MAGAZINE FIRE PROTECTOR

Paramount Device Corp. of Chicago announces a film magazine fire protector that is reported to absolutely prevent fire originating at the aperture from reaching the upper and lower magazines. In case of fire, the manufacturer states, the film slot is sealed by the instantaneous action of a spring-operated knife blade which is controlled by a fusible link. The blade cuts the film and seals the slot, it is claimed.

U. S. Patent No. 1,999,022 is cited by the manufacturers, with foreign patents pending.

• Notes From the Supply Field •

RCA Offers New Complete Visual-Sound Unit

COMPLETE visual and sound projection in one unit for theatre use is now being offered by RCA Photophone for the first time since it entered the theatre field. The sound system is of standard RCA High Fidelity design and manufacture, while the projector is the Super Simplex mechanism.

Heretofore RCA could offer a complete installation only in separate units—sound system and the projector—but now one complete unit satisfies both requisites. This new self-contained unit is expected to provide RCA with an important offensive arm in the battle it is now waging with Erpi and others on orders for both equipments and servicing.

This complete unit is perhaps best described by the official RCA release relating thereto:

Description of Equipment

"All of the outstanding features of the High Fidelity soundhead attachment have been incorporated. The economy to be effected by the purchase of a combined projector makes it a very desirable device. All components are mounted on a single casting, which simplifies manufacture and aids installation. Drive motors for all required power supplies are readily interchangeable. The use of precision ball bearings throughout provides trouble-free service and long life. A directly connected worm-and-gear arrangement is used for driving the soundhead attachment.

"The combination of projector mechanism, soundhead and lamphouse in one machine provides superior performance at a substantial saving. The projector is available with any one of three types of built-in lamphouses: an incandescent lamphouse for either a 900- or 1000-watt lamp; a 30-ampere low-intensity reflector-arc lamphouse; or a 45-ampere high-intensity, reflector-arc lamphouse. Power conversion apparatus is also available at additional cost.

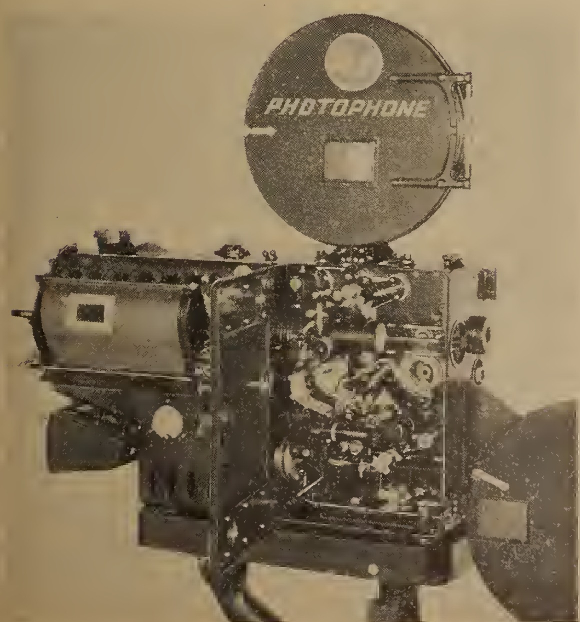
"In addition to the built-in lamphouse, superior features include a motor built in for quiet operation, gear drive throughout, 2000-foot magazines, and a 3- or 5-point pedestal base.

Projection Features

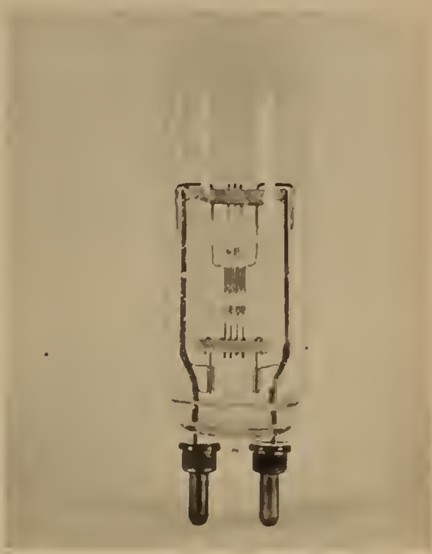
"The exclusive use of gear drive throughout assures constancy of speed. This method of drive is far more reliable than belts or chains for the transmission of power. The built-in motor is one of few with a hardened and ground shaft—increasing its life three to five times. The flexible coupling on the driving side of the motor acts as a mechanical filter, providing an even flow of power. The revolving cut-off shutter is placed between the light source and the aperture, reducing the heat upon the film fifty per cent—and thus permitting improved projection, increasing the life of the film, and reducing repair and replacement of parts to a considerable extent.

"An advanced lubrication system assures positive oiling of all rotating parts. The oil is fed to the shaft by manifolds leading to a porous-type bronze bearing, specially designed for long life, which absorbs the oil as required. This avoids over-boiling and eliminates the danger of having bearings bind through imperfect lubrication or neglect.

"The case of the projector is of cast aluminum throughout. The all-metal 3 or 5 point pedestal base is heavily constructed for rigidity, and adjustment is provided to tilt the equipment 10 degrees up or 26 degrees down."



Close-up of new RCA Photophone combined visual and High Fidelity sound projection equipment, showing the operating side open. First RCA offering of such a complete unit



New G. E. 35 mm. Mazda lamp (2100 watts, 60 volts) with biplane filament and bipost construction

New Mazda Lamp For 35 mm. Projectors

GENERAL ELECTRIC has recently made available a new projection lamp for use in 35 mm. motion picture projectors. Levels of screen illumination attainable with it are higher than with any other filament lamp and are double those obtainable with the familiar 900-watt, 30-ampere projection lamp. It is therefore particularly well suited for small theatres and permanent or semi-permanent installations in the larger church and school auditoriums.

The new lamp is rated at 2,100 watts and 60 volts. It employs a biplane filament designed for an average life of 50 hours, and its source dimensions and bulb diameter are such that it can be used effectively with the lens systems now generally used with incandescent lamps for this class of service.

Biplane, Bipost Construction

The accompanying illustration shows not only the general appearance of the lamp but also the bipost base (new to the projection field) with which it is fitted. This base is an important part of the new lamp because it enables the manufacturer to locate the filament with respect to a definite plane through the shoulders of the thimbles and thus provide much greater accuracy than heretofore. This obviates the adjustments in the lamp house previously necessary

for accurately positioning the filament. The bipost base makes possible a much more rugged construction as well.

Bulb Blackening Removed

Another interesting feature of this new lamp is the use of a cleaning powder inside the bulb for removing the bulb blackening, thus maintaining the high initial light output. By the simple process of removing the lamp from its socket, tipping it, and moving it back and forth, the blackening is removed. This should be done at intervals of not more than 10 burning hours to avoid the possibility of the blackening remaining long enough to become "burned into" the glass.

Proper Starting Method

As with all high-current lamps, best performance is obtained if low voltage is first applied when the circuit is closed to allow the heavy filament to heat up before full voltage is applied. This method of starting minimizes filament distortion and prolongs useful life. Transformers designed for the new lamp and providing such low-voltage starting facilities are now available.

While the biplane filament of the new lamp provides a source which is substantially uniform, a further gain in screen illumination of the order of 25 per cent can be obtained through the use of a spherical mirror behind the lamp.

New Anti-Fire Device Cuts Insurance Rates 20%

A reduction in insurance rates of 20% on buildings housing projection equipment (including theatres) which is protected by the Hawkins Projector Safety Device is announced by the Academy of M. P. Arts & Sciences, which has just concluded negotiations with the National Board of Fire Underwriters. Tests extending over three months were conducted at the RKO studios.

The device consisting of a specially adapted sprocket fitted to the projector, with the necessary electrical relays and switches, operates to stop the projector motors and shut off the arc light whenever a break in the film occurs, thus eliminating fire hazard due to film breakage. Tests indicate that the arc light is shut off in approximately one-third of the time necessary to ignite acetate film, thus precluding the possibility of a film fire.

I. P. has requested complete details and reports of tests made of this Hawkins device, upon receipt of which it will set forth its opinion as to the worth thereof.

Akron Wage Scale Rise

Local 364 of Akron, Ohio, has announced an increase in wages of $5 per man, or 8 per cent, over the present scale. The increase will become effective Dec. 1, to be the contract negotiation date henceforth.

Shutter Elimination, Double Present Light Forecast For New Mercury Vapor Projection Light Source

Accuracy of the appended statement anent a new projection light source, emanating from its sponsors, the Philips Co. of Holland and England, is not guaranteed by I. P. and is presented herein for what it may be worth in terms of general interest. Offhand, it is obvious that the use of extremely high voltage such as is required for this type of light source, presents several not inconsiderable operating difficulties.—EDITOR.

A NEW type of mercury vapour lamp considerably smaller even than the smallest domestic lamp bulb, yet brighter than the sun, has been developed in the Philips Laboratories, London, England.

It is claimed that this lamp will completely revolutionize all industries dependent in any way on super-brilliant illumination, and will abolish the revolving shutter of the cinema projector. Already one single lamp is being used to floodlight a large aerodrome.

The secret of the lamp's brightness seems to be the enormous pressures which constructional improvements have made possible. It works at a pressure of no less than 150 atmospheres, while experimental lamps have been made working at twice this pressure, with a brilliancy twice as intense.

Some Interesting Comparisons

The magnitude of this advance in the technique of the mercury lamp may be gauged by comparison of the following figures. Before the constructional discoveries which led to the present lamp, a mercury lamp of 9 kw. with a luminous flux of 500,000 lumens (about 40,000 candle-power) could not be made smaller than about three feet in length and three inches in diameter. One of the new Philips lamps of the same power is no larger than the stump of an ordinary lead pencil—an inch long, and a quarter of an inch thick.

The discoveries which made this enormous reduction in size possible were, summarily, the use of water-cooling (the lamp works at a temperature of from four to eight thousand degrees Cent.) and the perfection of a method of applying this; the use of quartz instead of glass, to withstand these terrific temperatures, and the tremendous pressures referred to previously, and finally the discovery of a method of sealing thick tungsten wires into the quartz tubes. The electrodes are of mercury, with specially prepared projecting tungsten wire points.

Numerous Applications

Floodlighting, searchlights, spotlighting, photography are among the more obvious uses for this amazing little lamp. It is also claimed that it will be particularly useful for medical purposes, since its light is whiter than any mercury lamp yet invented. Unlike the ordinary mercury lamp it shows a continuous spectrum, including almost the full quota of red—a band usually absent from mercury light.

Experiments are now continuing with an even smaller lamp which will be at least one-eighth brighter than the sun.

The demonstrations were given with two sizes of lamps, one working at 600 watts, which it is claimed gives 600 lumens per watt, and one working at 1,000 watts, giving 80 lumens per watt.

The elimination of the projector shutter would double the light reaching the screen and would be made possible by extinguishing the lamp twice per cycle and synchronising the movement of the film with this extinction. The working voltage is at a pressure of 1,250 volts per inch, when the lamp consumes 1,500 watts at a consumption of approximately 1.35 amperes.

Mystery of Projectionists' Darling Solved; M-G-M Technician Breaks Case of Print Leader Close-Up

THE eminent Dale Danielson, of Russell, Kansas, deposits a letter in the mail sack that not only revived a topic which we considered to have been settled long ago through the medium of our boundless wisdom and faultless logic. but also embarrassed us greatly.

Here's the Danielson opus:

"I am another of the mass of projectionists who would have appreciated a sensible answer as to the reason for the five frames close-up of a girl just preceding the 11-foot mark on M-G-M pictures. One can readily see that you didn't give the matter a second's thought.

"Now, wouldn't it be a strange coincidence to have exactly five frames missing just before the 11-foot mark on all Metro pictures in all parts of the country, and that they would use these same five frames on each reel? Further, these five frames are *not* spliced in; they are an integral part of the leader. Moreover, these frames appear all over the country, and not just in Los Angeles and New York.

"Even before the S.R.P. these five frames appeared on Metro feature leaders. They disappeared for a while, and then reappeared after the S.R.P. adoption. Yes, this certainly is true economy on the part of M-G-M, who handle millions of feet of film yearly, yet preserve these same five frames. Why, the style of clothes and hairdress of the girl indicate that they have been holding the same strip of film for years.

"So, along with many other projectionists, I would appreciate a sensible answer to this question."

We were just reaching for the borax

(*Continued on 2nd page following*)

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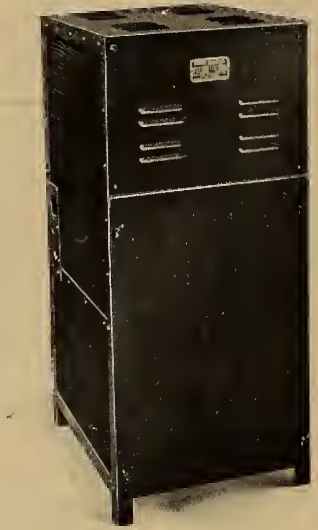

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with which to allay the sting of the foregoing, when along came a letter from H. B. Smith, resident of West Springfield, Mass., the fellow who caused all the trouble by first posing this question. Attached to his welcome missive was a letter from John M. Nicolaus, Superintendent of Photography for M-G-M, whose statement tends to relieve the tension all around.

"These five frames represent part of our control system. The original is the plant master negative, the object of which is that when each reel is printed, developed and finally inspected, these frames must absolutely reproduce the plant master, thus insuring uniform prints.

"This is the result of many years of research work to bring our work up to a degree of efficiency whereby all our prints are produced with definite gamma and density control, and no doubt you will agree with me when I say it has resulted in a finer degree of uniformity through our prints than we have ever been able to produce before.

"It is very gratifying to know that projectionists, who unfortunately we never have the opportunity to contact, are taking sufficient interest to make inquiries of this kind. It shows signs of progress."

Like all good stories, this one just must have an anti-climax. One projectionist mug had the gall to write in and say that, not interested in how the girl's close-up got there, he *demanded* to know who the girl was!

New Tube a Combined Cell and Amplifier

RADIO experimenters have often toyed with the vision of a tube that would combine the functions of many tubes within a single envelope. Engineers have succeeded in designing tubes with a double or triple purpose, but little has been done beyond that point.

Now comes Dr. V. K. Zworykin of RCA-Victor's television research laboratory with an electronic tube which has already been built with twenty-five stages of amplification, probably the equivalent of ten to fifteen standard tubes, reports the *N. Y. Sun*. The tube, which he calls an electronic amplifier, was described recently by Dr. Zworykin before 1.000 members of the Institute of Radio Engineers.

The Zworykin electronic amplifier is about an inch longer than the 59 tube and about half its diameter and is fitted with the new octal base developed for metal radio tubes.

Electrodes In Two Rows

Inside the amplifier is a double row of electrodes extending the full length of the bulb. The electrodes in one row are coated with a preparation of caesium and act as targets for the bounding electrons. Opposite each target is an electrode which supplies the electrostatic field to guide the electrons in the desired path. Around the outside of the bulb are permanent magnets which combine with the electrodes inside to control the electron flow.

The tube operates as follows: From

a cathode at one end of the bulb electrons are driven against the first target. As they hit the target the impact sets free other electrons called secondary electrons. These new electrons tend to shoot off in every direction, but are herded back into the desired path by the combination of electrostatic and electromagnetic fields.

By properly spacing the successive electrodes the augmented electron stream gathering momentum at each impact hops and skips from one target to the other in progressive steps. Starting with only a relatively few electrons at the cathode the stream becomes a sizable current flow by the time it reaches the positive plate at the other end of the tube. Gains of several millions have been obtained from a tube with ten stages.

Combination Cell-Amplifier

The use of this tube to replace present tubes in radio sets is merely visionary. There are many other problems to solve before it would be practicable. But as an amplifier for photo-cells it has already proved its worth. The sample tube demonstrated by Dr. Zworykin included in its makeup a photo-cell, thus combining in one unit the cell and its necessary high-gain amplifier.

The tremendous amplification of the tube with its low noise level—the ratio of signal to noise is sixty to a hundred times better than that of standard tubes —makes it particularly suitable for use with television camera or iconoscope where the minute impulses generated on the mosaic of the sensitized surface must be built up many millions of times before they are sufficiently powerful to modulate a transmitter.

In this demonstration before the institute, Dr. Zworykin used a phonograph, a neon light, a lens system and the electronic multiplier which in turn operated a loud speaker.

The slight currents produced in the pickup head were used to modulate a neon lamp. The beam from the lamp was collected and directed across the room onto the photo-cell within the electronic amplifier and the output of the latter was then turned into the loud speaker through an output transformer. Although the volume was great enough to fill the large auditorium, the output of the electronic amplifier despite its gain of 5,000,000 was free of all noise, as Dr. Zworykin demonstrated by intercepting the beam while the phonograph was played.

The tube is said to be free of frequency distortion between any limits used in radio applications.

THE MONTH'S NEWS

N. Y. City Settlement

Local 306 has settled its difficulties with at least the major circuits, and is now dickering with independents. Some mystery surrounds seven-year contract with majors, the Union asserting that it calls for revision *upward* every year after the first two, and the circuits stating that scale will be *arbitrated* hereafter by a board composed of two Union men, two circuit men and one imperial choice of the four.

The N. Y. de-luxers will continue to pay \$2.55 an hour straight time, then \$3.83 for next two hours and \$5.10 thereafter. Overtime is only a dream, however, because Union has some de-luxers jammed with as many as 11 men weekly, due to unemployment. Average weekly pay per man in de-luxers will be around \$55, so few are hours.

Loew and RKO circuit houses have settled for \$1.86 per hour per man, with two men to a shift. Here again the excess manpower will pare the individual pay envelope way down. Other circuits will pay \$1.49 hourly.

One unique angle to the L. 306-circuit settlement was provision for a week's vacation *with pay* for every man during the summer months.

Local 306 evidently is committed to policy of taking in two rump unions in N. Y. City—Allied and Empire, with 600 men. This move would swell L. 306 membership to 2500, in the face of known fact that there are only about 2000 projection jobs in city on basis of

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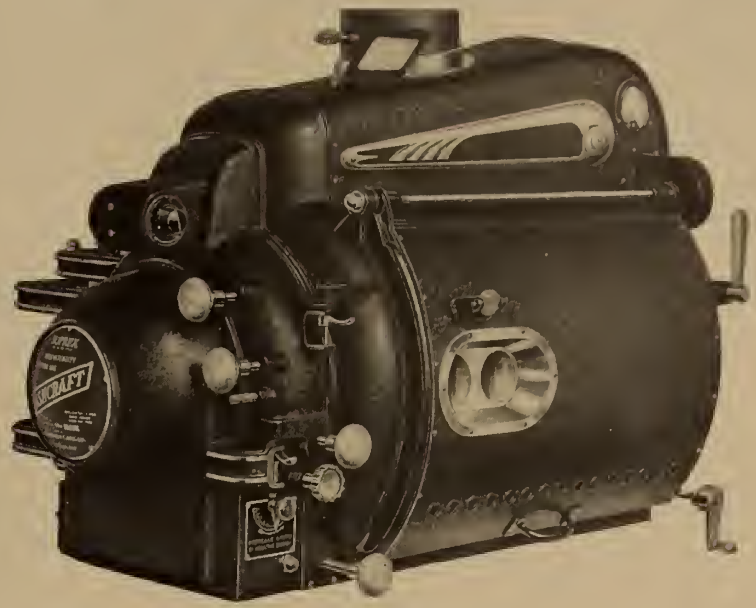

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a decent week's pay for each man. Also, no word comes from L. 306 officials as to what will be done about the other 4000 projection licensees known to be floating around New York.

S. R. Burns Recovering

S. R. Burns, president of International Projector Corp., is convalescing from a recent serious operation. His condition is reported to be very much improved, but he probably will be unable to return to business for quite some time.

L. 327 Sound Service

Local 327, Cincinnati, is now offering a sound and visual projection service to all exhibitor clients. Basis is two regular monthly calls, with emergency service as needed, all for flat rate of $15 monthly. Union emphasizes no-profit motive, desiring only to break even. Complete sound truck is used, parts being supplied at cost. One-third of exhibitors have signed.

Ex-Erpi man, K. Pitts, is director of service, described by Union as helping members to become more proficient and

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aiding better understanding between Union and exhibitors.

I. P. was given no credit for foregoing, but it takes a bow anyhow.

Milwaukee Strike Ends

Agreement to negotiate ended four-day Milwaukee projectionist strike that forced closing of 41 neighborhood theatres. Union asked for 7½% boost in scale. Downtown de-luxers average $80 per man, and neighborhoods $50.

Insurance Ruling

N. Y. Appellate Division has ruled that an insurance company must pay $15,000 for the death of a projectionist in a fire at Schine's Empire, Glens Falls, N. Y. Court upheld decision of the State Compensation Court.

Insurance company contended that because of change in name in the Schine operating company it was not liable for damages in the death of William J. Brady in an explosion and fire. Brady left a widow and five children.

Double Reel Progress

Despite growing Union opposition to the proposed double-reel standard, the Academy of M. P. Arts & Sciences expects to have project lined up by the end of the year, with the plan to become effective April, 1936. Unions now opposing longer reel are Boston, Chicago, Cleveland and New York, although nothing official has come from latter.

Hearing in Chicago early in December will relate to change in municipal code to permit storing and running of double reels. Chicago exhibitors are understood to strongly favor longer spool. Omaha has already fallen in line with a revamped city code.

Free Show Menace

Current *Bulletin* of Motion Picture Theatre Owners of America discusses the free show menace, of great importance to Labor as well as to exhibitors, as follows:

"Complaints are pouring in from exhibitors in various parts of the country of unfair non-theatrical competition of professional entertainment given away by advertising sponsors or given for nominal admission charges under the guise of helping some worthy cause.

"Perhaps the unrestrained cut-rate competition that is breaking out between theatres may divert attention from this menace but it seems to be developing rapidly."

Print Shortage Acute

Projectionists have joined exhibitors in protesting strenuously the acute shortage of prints, a condition that has existed for several years now. Projectionist interest in topic was spurred by several recent disastrous room fires in which several men were burned to death.

It is estimated that prints today are being run almost three times as long as they were in 1930, the result of an economy campaign by distributors. Overworked prints inevitably develop defects and constitute a continual fire hazard.

Board of Fire Underwriters is understood to be interested in matter and only awaiting reports of field investigators before making strong representations to distributors. Latter apparently would do nothing to relieve situation except for Underwriter pressure.

Print shortage is considered only one element of this dual problem, the other being delinquency of exhibitors in repairing and replacing worn and damaged projector parts.

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U. S. Patent No. 1,771,591, issued July 29, 1930, covering the automatic opening of electrical circuits to prevent the coils burning out;

U. S. Patent No. 1,796,970, issued March 17, 1931, covering the change-over of the picture and sound;

U. S. Patent No. 1,771,590, covering the positioning of the change-over device between the lens and the screen.

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S.M.P.E. PAPERS PROGRAM

(*Continued from page* 12)

P. T. Newsome and S. S. Sweet, Eastman Kodak Company.

The Need for Real Projection Departments in Theatre Chains; F. H. Richardson.

Thyratron Reactor Theatre Lighting Control; J. R. Manheimer.

The Art and Mechanism of Cutting a Picture; R. Snody.

Report of the Standards Committee; E. K. Carver, *Chairman*.

The European 16-Mm. Sound-Film Situation; A. N. Goldsmith.

Sixteen-Mm. Optical Systems; G. Mili, Westinghouse Lamp Company.

Report of the Sound Committee; P. H. Evans, *Chairman*.

Practical Splice Blooping; E. I. Sponable, 20th Century-Fox Film Corp.

A New Method for Increasing the Volume Range of Talking Motion Pictures; N. Levinson, Warner Bros.-First National Studios.

Critically Damped Filters; J. Livadary, Columbia Pictures Corp.

Reversed Mechanical Bias on Light-Value Recordings; E. H. Hansen, 20th Century-Fox Film Corp.

Primary Considerations in the Design and Production of Theatre Amplifiers; T. D. Cunningham, RCA.

The Debrie 16-Mm. Professional Projector; H. R. Kossman.

A New Non-Intermittent Editing Machine; J. L. Spence, Akeley Camera Company.

A Neon Type Volume Indicator; S. Read, Jr., RCA.

Report of the Committee on Laboratory Practice; D. E. Hyndman, *Chairman*.

Progress and Achievements in Infra-red Photography; J. Eggert, Agfa Ansco.

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PROJECTS CITED BY SMPE SOUND COMMITTEE

(*Continued from page* 20)

the secondary standards can be calibrated in terms of the primary standard. Thus we shall have for the work of this Committee, a datum plane or benchmark to which all measurements can be referred and, therefore, correlated with each other. To begin with, it was decided to make six secondary frequency reference standards. The stock was furnished through the courtesy of the Eastman Kodak Co., the printing and developing by De Luxe Laboratories, and the calibrating by Warner Brothers.

The film referred to above has the variable-width type of track. A second similar film of the variable-density type is being made so that the relative permanency of the two types of track as reference standards can be studied.

Within the next few months, therefore, the various studios may expect to be requested to furnish to the Sound Committee information on their recording characteristics, expressed in terms of their deviation from the primary frequency reference standard. From these data it is hoped that the Sound Committee can arrive at a recording frequency characteristic that they can recommend.

Studio-Theatre Level Balance

The object of the second project is to obtain, from the level standpoint, a more artistic rendition of sound in the theatre. In other words, the "level balance" that the producer had in mind at the time the record was made should be preserved, and the projectionist should be enabled to pre-set his reproducing equipment, without rehearsal, so as to create the effect intended.

If all producers will determine the normal or reference setting for reproduction in their review rooms, and all theatres will do the same, it will then be possible to mark upon all release prints the deviation from this normal which would be required in any review room or theatre to create the effect and loudness desired. In order to determine the normal or reference setting in review rooms or theatres, taking into account also personal tastes as to loudness, a standard test reel will have to be selected. This may be the S. M. P. E. Standard Test Reel or a reel chosen especially for the purpose by the Committee.

Relative Loudness Factors

Two factors determine the relative loudness, on a given equipment, of two successive reels: (1) the percentage of modulation used in making the negative, and (2) the processing of the print, in which density or transmission is the most important factor. If the producer, when previewing the No. 1 print made from the release negative, would determine the deviation from his normal setting required to create the loudness and the effect he wishes, this deviation expressed in decibels would represent the deviation from normal in any other place for all prints having the same density as the one that he previewed.

If the laboratory making the rest of the release prints were given this information, as to the level in decibels above or below normal at which prints having the same density as the No. 1 print should be played, the laboratory could then determine from a table showing the variation of level with density the correct playing level for all prints whose densities differ from that of the No. 1 print. This information could then be written or punched at a suitable place upon the leader; for example, it might be incorporated as part of the 24 frames of "identification leader" of the Standard Release Print. After noting the deviation from normal marked upon the reel, the projectionist could play the reel at the correct level in his theatre by making the indicated setting on his equipment.

The object of the third project is to study the processing characteristics for sound-film used by various producers, to the end that greater uniformity may be achieved in processing methods. As the Technicians' Branch of the Academy already has a Committee working upon the problem, it is felt that the Sound Committee of the S. M. P. E. should endeavor to cooperate in any way possible with the Academy in an effort to expedite the work. We believe that when the Academy first undertakes to standardize the measurement of film densities it is attacking the problem in the correct manner. The Sound Committee is being urged to study the problem in the hope of assisting the Academy to eliminate the rather wide divergence apparently existing at the present time

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in the measurement of sensities by the various studios.

The object of the fourth project is to evolve, if possible, a simple and inexpensive method of making rough measurements of the acoustic frequency characteristic of review rooms and theatres, to the end that review rooms and theatres may be adjusted so that a given print will sound more nearly the same when reproduced in the various places. It has been suggested that if a wobble-frequency film, fulfilling certain conditions, were available, measurements could be made quickly and inexpensively, enabling the engineer more nearly to approximate ideal reproduction conditions. This proposal was not made with the thought in mind that it would supersede the more refined and accurate work now being carried on by the acoustical experts, but would make available to those who could not afford or who did not have access to the more refined and accurate methods a means for making a first or coarse adjustment of their reproduction conditions.

In closing, the Committee wishes to commend the newsreels upon the marked success that they have attained in standardizing the loudness of their release prints.[1]

Discussion:

Mr. Sandvik: The Sound Committee feels that the question of uniform frequency characteristic of the talking motion picture, as heard in the theatres, is the most important problem that it has on hand and we should welcome very much any information available bearing upon the problem. It is a very far-reaching problem, taking in all operations that have any relation to the sound, from the recording studio to the theatre (i.e., the acoustics of the theatre), and all that the Sound Committee can hope to do is to initiate thoughts along these lines, hoping that finally something will come out of them.

For the purpose of illustration, let us assume that through a careful study of the theatre acoustics, and other factors that enter into consideration, the most satisfactory characteristic of the frequency spectrum that should be fed into the average theatre has been decided upon. Let it further be taken for granted that somewhere in the process it will be necessary to equalize; that is, to boost the high-frequency end of the spectrum with respect to the low-frequency end.

The question then is, at what stage or stages in the process should the equalization take place? Or, to make it more concrete, which will result in a greater volume range, for example, to introduce equalization in the original recording system or in the final reproducing system?

The answer to this question is quite evident, but the information in the literature on this general subject is very limited.

[1] "Newsreel Sound Quality is Greatly Improved," by T. A. Battle, I. P. for August, 1935, p. 13.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF MARCH 3, 1933.

Of International Projectionist, published monthly at New York, N. Y., for October 1, 1935.

County of New York }
State of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared James J. Finn, who, having been duly sworn according to law, deposes and says that he is the Editor of International Projectionist and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, James J. Finn Publishing Corp., 580 Fifth Avenue, New York, N. Y.

Editor, James J. Finn, 580 Fifth Avenue, New York, N. Y.

Managing Editor, None.

Business Manager, Ruth Entracht, 580 Fifth Avenue, New York, N. Y.

2. That the owner is:

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

James J. Finn, Editor

Sworn to and subscribed before me this 24th day of September, 1935.

(Seal) JOSEPH HOFF

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November 1935
Vol. 9 No. 5

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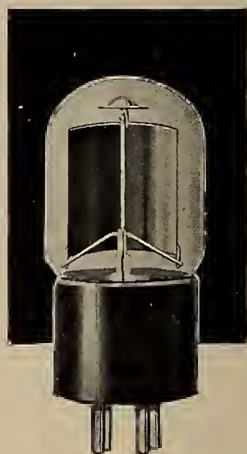

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Volume 9 NOVEMBER 1935 *No. 5*

Index and Monthly Chat 5

Suprex Data: Mirror Pitting, C. O. Rectifiers, Lamphouse Glass 7
EDWARD M. CROCKER

Hints on Projection Room Ports 8

Practical Tips on Soldering ... 10
A.H.FALK

All Majors, Except 'U', Agree on Double-Reel Release Date 12

New All-Purpose Theatre Sound System Tester 14

Step-By-Step Analysis of Theatre Reproducing Systems, XVI 16
AARON NADELL

Servicing Situation Acute; Prompt Action By Craft Vitally Necessary 19
JAMES J. FINN

The Editorial Page 21

Christmas Seals and the Work They Do 23
A. J. SCHAEFFER, JR.

Notes From the Supply Field .. 24

News Notes

Technical Hints

Miscellaneous Items

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420

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MONTHLY CHAT

THE degree of service that I. P. can render to its readers is dependent in large measure upon the degree of interest and cooperation exhibited by the field. By which is meant, boiled down, the frequency with which readers reach for pen and ink or a typewriter and get their ideas anent projection off their chests.

OF RECENT weeks there has been a great increase in the number of letters from readers. The content of these letters was surprisingly free from squawks—the usual thing—being concerned with down-to-earth practical questions and suggestions. Pretty soft for I. P., you say; and we agree. But pretty swell for I. P. readers, also, because several topics touched upon will be productive of much future material that is valuable to the craft.

We encourage an extension of this practice, even though the letter take the form of a brickbat, the conversion of which into a boomerang being a particular knack of ours.

KEEP projection room ports closed! And leave an opening for the projector port of only sufficient circumference to permit passage of the light beam. Now that the balconies are habitated once more by paying customers, extend a break to those who pay the freight. Of this more within; but it deserves this special additional note.

FREQUENTLY classified as a "trade" paper, I. P. is nothing of the sort. I. P. is 99% a "craft" paper. Most trade papers elect to serve, first, the advertisers who pay the bills, after which the readers get a break—provided it doesn't conflict with the advertisers' interests. I. P. has repeatedly demonstrated its complete independence in this respect. I. P. serves the craft first, and therein lies its strength, because advertisers *must* defer to craft opinion, which in turn is moulded by I. P.

MORE hooey has been circulated anent the Suprex arc than about any other recent projection development. Why? Because the conveyors of half-truths and downright misrepresentation about this type arc rely upon an uninformed craft to gain acceptance for their ideas. Continuing its campaign of enlightenment on this arc, I. P. explodes a couple more Suprex myths in this issue.

FROM New Hampshire comes this comment relative to I. P.'s disapproval of reflector shields: "I note that you withdraw approval of reflector shields. This is what makes I. P. a great paper. When you find you have gone wrong on something, you stand up and say so."

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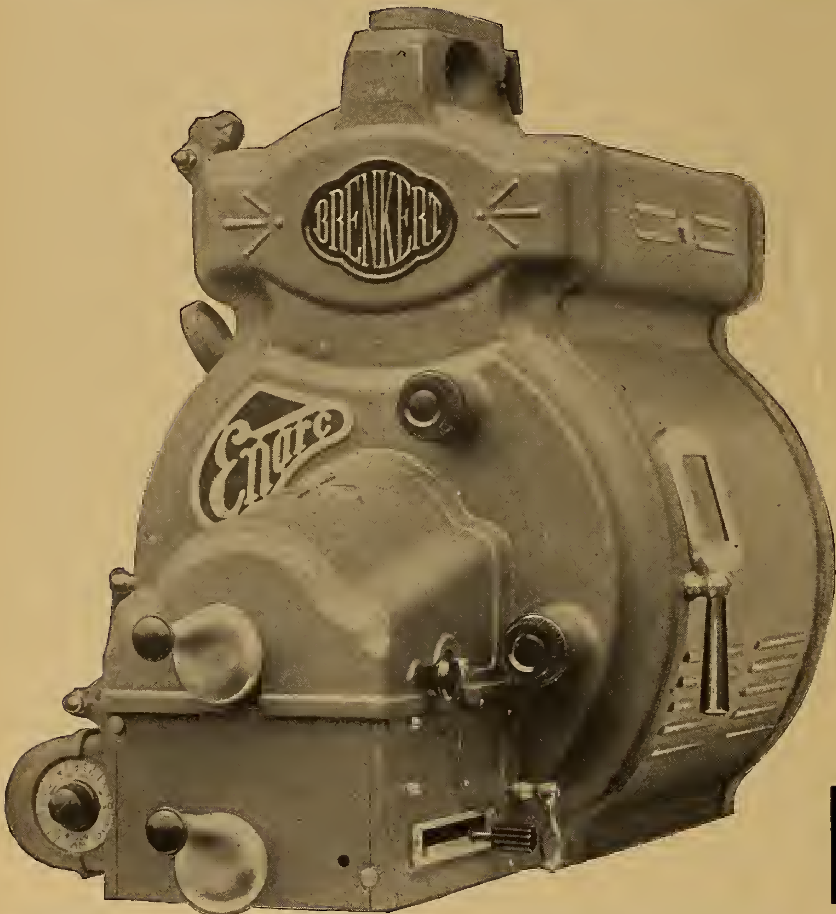

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VOLUME IX NUMBER 5

NOVEMBER 1935

Suprex Data: Mirror Pitting, C. O. Rectifiers, Lamphouse Glass

By EDWARD M. CROCKER

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THE Suprex arc has occasioned the circulation of more unadulterated nonsense relative to design, characteristics, operating technique and requisite accessory equipment than has any projection development of the past decade. Of course, the projection field always has been the unwilling beneficiary of voluntary endowments of humor by manufacturers and supply men, thus the present crop of old jokes anent the Suprex arc merely marks the extension of a venerable tradition.

I. P. has striven valiantly to dispel these hoary myths, and to its credit it may be observed that the craft has been far less gullible on the score of Suprex data than on any other development of similar importance. But manufacturers and supply dealers believe in nothing if not in the old adage that persistence ranks high among the acknowledged virtues, hence this article.

Three pretty good examples of the story-telling art (developed to a high degree of perfection by equipment salesmen and lent credence by self-appointed projection oracles) are now making the rounds. These stories relate to (1) the elimination of mirror-pitting, (2) the ageing of copper-oxide rectifiers, and (3) the use of a glass between lamphouse and aperture to protect the admittedly critical Suprex arc from drafts, stray or otherwise. Let's poke into these stories and attempt to ascertain their content of truth, or lack of it.

Why and How of Pitting

Mirror-pitting is a topic near and dear to this writer's heart. Already rendered in these columns is an opinion as to the worth of the so-called reflector shields which, so to speak, bloomed in the morning and died before sunset. These shields were grand in principle, but shortly after their introduction principle evidently took a holiday, if one is to judge by performance records. This foray by I. P. into the realm of fact left in its wake a string of broken hearts, loud lament and thinning purses. But the craft was handed the facts, and that's really all that counts.

But to get on. The thanks of the craft are due to Sam Cooley, energetic business representative of Manchester, N. H., L. U. 195, for the appended contribution to the science of projection:

> "I notice in I. P. that you withdraw approval of reflector shields. This is the reason why I. P. is a great paper: when you discover that you have gone wrong on an item, you come out flatfooted and say so.
>
> "Here is an operating hint on Suprex lamps. To stop pitting of reflectors, place in the drip pan under the arc a layer of fine sand. As the hot metal drops from the arc while it is operating, the metal will not spatter on the mirror. Also, if proper care is taken not to freeze the carbons too long when striking the arc, reflector damage will not occur."

The arc-striking hint is eminently correct, and is a fundamental of Suprex arc operation. Mr. Cooley's pitting data, however, is a repetition of a wholly erroneous impression that has been widely circulated and has won too easy acceptance by the craft. Exhibitor papers printed this item to death, and the path from the manager's office to the

projection room seems to have afforded speedy transit.

Mr. Cooley's most welcome contribution uncovers two errors of thought with respect to mirror pitting by the Suprex arc, as follows: (1) that practically all pitting occurs when the arc is struck, and (2) that a piece of moderately warm metal merely peels off the carbon and languidly drops into the drip pan. What are the facts?

Pitting is Continuous

First, the pitting process in Suprex arc operation is continuous throughout the burning of the carbon trim. By *continuous* is meant just that and not *intermittently*. If pitting occurred only when the arc were struck, the solution to the problem would be a lead-pipe cinch. This fairy tale was first related by several enterprising manufacturers who knew a good story when they told one, even though it were untrue.

Second, the Suprex pits are not moderately warm and do not languidly drop into the drip pan. The pitting process is in reality a *bombardment* of the mirror by highly-heated particles travelling at a high rate of speed. Thus, *temperature* and *velocity* of the pits are the all-important considerations that seem to have escaped the attention of almost all projectionists.

Examine any mirror that has been used with a Suprex arc for as short a period as two weeks. One will find that the mirror bears two markings that clearly indicate the character of the pitting process: deep dents at irregular intervals across the mirror face, and a fine smudge overall. The dents are made by red-hot metal particles driving against the mirror at high velocity; while the smudge is the residue of the cerium in the carbon that is continually being sprayed about within the lamphouse.

Metal Mirror Possibilities

Numerous attempts to eliminate mirror-pitting have come to the attention of the writer, but only one seems to hold any promise of success—a good metal mirror. Several types of metal mirrors are available, but their development has been hampered by, among other less important things, insufficient reflectivity, uncertainty as to uniformity, and high cost. Metal mirrors having a high reflectivity (one matching that of glass) are available now; but can the manufacturers assure a steady supply of uniform quality? A test of one metal mirror over a period of six months resulted in no indication of pitting (dents), and the cerium smudge was easily removed with a soft cloth. Moreover, this mirror was subjected to the flame from a blowtorch without any appreciable harmful effects.

Metal mirrors are much more expensive than glass mirrors, true, but a metal mirror costing two, or even three, times the cost of a glass mirror undoubtedly would last three times as long. Unfortunately, theatre managers and owners are prone to think only in terms of first cost, irrespective of quality and durability. The writer is confident that some means will be found to insure uniformity of metal mirrors and to merchandise them effectively.

C. O. Rectifiers

Copper-oxide rectifiers, which successfully weathered every storm of criticism in the book when first introduced, now seem to be staggering under the load of compliments unloosed by over-enthusiastic users. Some months ago there appeared herein the report of a capable investigator assigned by I. P. to check on the ageing of copper-oxide rectifiers. This report, in part, stated:

"The very first units which were put into service eight months ago still are running at the initial setting without any decrease in ouput. Ordinarily we could expect that the ageing during the first six months would be more rapid than at any other time, and I believe that the makers originally calculated that it would be necessary to readjust the transformer connections after this period of service, going to the next higher series of taps.

"I have been unable to find a single case thus far where it has been necessary to make any change in the setting, even on the oldest units—that is, eight or nine months old. The matter may be kept open, with a further check to be made within, say, another six months."

The latest addition to the collection of projection myths is the story now making the rounds to the effect that, far from ageing rapidly and requiring readjustment of the taps, the copper-oxide rectifier actually improves with age. At hand now is a report supplementing the foregoing and bearing on this very point. Witness:

No Change in a Year

"Unfortunately, the theatre selected for checking the operation of the copper-oxide rectifier installed a year ago has closed, the equipment being transferred to another theatre. At the new location the wiring between the rectifier and the lamps is apparently somewhat heavier than at the old location, because the rectifier now delivers a higher output than formerly with the same line voltage and the same adjustment of the transformer connections. In fact, it was necessary to change the adjustment to the next lower set of taps in order to get the current down to 50 amperes.

"This incident seems to have started a story going around that the copper-oxide rectifier actually improves with

Hints on Projection Room Ports

FROM too many projection rooms there issue a varied assortment of noises that are wafted out across the balcony and definitely interfere with the enjoyment of the picture by the cash customers. Machine and tool noises are frequently supplemented by choice conversational tidbits exchanged between brother craftsmen in their zeal (?) to put on the best possible show.

The answer to this situation would seem to be the closing of all room ports, including a definite limitation of the size of projector ports. But this is not as simple as it seems. In all too many theatres the only possible means of room ventilation is through the ports; and if this smoke- and dust-laden air constitute ventilation, then one can easily understand the need for enlarged sanatoria for projectionists.

This is the condition existing in many theatres, a change in which will not be effected until enlightened projectionist leadership insists upon working quarters at least a trifle better than a pig-sty.

Glass Projector Ports

Numerous requests for information on the treatment of ports have been received. I. P. does not recommend the use of glass, irrespective of its quality, for projector ports. Dealers in high-quality optical glass, as it is commonly designated, themselves agree that the use of glass occasions a light loss of about ten per cent, which, added to other serious losses in the projection train, simply is not tolerable.

One large circuit utilizes transite board on which is marked out an area sufficient to accommodate the light beam, after which the board is mounted into the port. All other ports are covered with ordinary plate glass. Of course, glass cannot be considered to be absolutely soundproof, but it will meet all normal requisites of the situation.

Health First Consideration

I. P.'s interest in high projection standards certainly is not exceeded by any other individual or group. In theatres where the ports serve as the only means of ventilation, however, I. P. is of the opinion that the health of the projectionist must take precedence over the requisites of a perfect show—until such time as the management recognizes the projection crew as no less human than the audience. Under such circumstances, I. P.'s advice is to leave the ports open and do the best one can to make the best of a bad bargain.

Do your audiences say—

"It looks like him, but . . . ?"

Motion picture photography and projection have reached a high stage of perfection, having had a great many years in which to develop. Sound is younger, however, and has moved ahead so fast that methods and equipment only a few years old cannot do justice to today's sound tracks. Many a man and woman today sees a star on the screen, and says: "It certainly looks like him, but it doesn't sound like him." So customers go elsewhere, to theatres whose sound is modern and natural.

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50% OF THEATRE SOUND BAD!

Read what Mr. A. Lightman, former president of MPTOA, and president of the Malco circuit, said recently in Hollywood. He spoke before the Technician's Branch of the Academy of Motion Picture Arts and Sciences:

"There is equipment today in some of the de luxe houses which is the original equipment installed in 1927 and 1928. No provision has been made in these houses to take care of what you are doing here now. The best results cannot be obtained from such equipment. Fifty percent of the theatres today won't get any more out of your product than just ordinary results . . . The exhibitor has an obligation to the industry to keep his equipment up to the best possible efficiency."

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age. This is ridiculous, of course, and I feel sure that the increase in output is due entirely to the better wiring.

"While the change in operating conditions has spoiled the test data being collected, I think it safe to say that there has been no appreciable ageing to date in this pair of rectifiers which have now been in service a year."

This much having been said, a neat job of interring another projection myth has been done with creditable dispatch. Next.

Lamphouse Cone Glass

The Suprex is the indisputed prima donna among projection arcs. Any slight irregularity in carbon feed, any deviation from a normal arc gap, and even the slightest draft is enough to disturb the smooth operation of this delicately attuned arc. These facts we all know, or find out quickly when operating a Suprex arc. Almost all manufacturers recognized the obstreperous qualities of this arc from the first stages of its development, and were careful to insure a steady feed and to stress the importance of an accurate arc gap.

But what about drafts? This evidently was something on which everybody concerned was disposed to take his own chances, from which decision there ensued some highly interesting results. Not a few projectionists and supply dealers, in an effort to correct this condition, utilize a circular piece of glass in the lamphouse cone. Bearing on this procedure is the appended communication from Nash Weil of the Wil-Kin Theatre Supply Corp., Atlanta, Ga.:

Utilize Glass Protector

"We have on several occasions utilized a circular piece of optical glass in the cones of Suprex lamphouses where the combination of drafts from rear-shutter mechanisms and lamphouse vents caused sufficient air motion within the lamphouse to disturb the arc flame. We have not found this condition general and therefore have not resorted to the use of optical glass in many cases.

"As accurately as we could determine by photometer tests, the light loss was approximately 6% when the glass was kept perfectly clean. Under normal operating conditions, however, we found that some projectionists did not exercise the care they should in keeping the glass cleaned and polished, which caused an increasing light loss.

"We do not think the use of glass in this way should be recommended except in cases where agitation of the arc flame cannot be otherwise eliminated."

If agitation of the arc flame may be eliminated only through the application of such remedies, this writer would prefer to eliminate this type of arc itself. Mr. Weil's finding of only a six per cent light loss as a result of using this glass appears rather conservative in view of previous experiences with transmitting light through glass. While hazarding the guess that the resultant light loss is considerably more than six per cent (the wonder being just what sort of spot on the aperture is obtained) the writer intends doing a bit of experimenting along these lines as a check on this finding.

Rear-Shutter Action

Concerning the undesirable effects of rear-shutters upon the Suprex arc, at least one shutter is available which does not react unfavorably upon the arc, this being the one having a guard open at the sides and permitting ample cooling without exerting either a drawing or a blowing action upon the lamphouse. It is simply a matter of shutter design.

Even should the light loss be as low as six per cent (which is to be seriously doubted) the trouble with such applications is that projectionists invariably forget the necessity for using a "quality" glass and proceed to use any type of glass most convenient. Experience of the craft with glass covering for ports adequately illustrates this point.

Insufficient time remained prior to publication of this issue of I. P. to subject Mr. Weil's suggestion to a practical test (although this writer frankly admits a great skepticism as to the worth of the idea) but it is intended to make such a test in ample time to insure publication in the next issue.

Practical Tips on Soldering

By A. H. FALK

MEMBER OF THE TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

THE joning of metallic materials by means of another material of lower melting point dates back to the days of the early metal craftsmen. Before the advent of modern machine methods and welding or brazing procedures, metallic parts had to be joined either by riveting or forging operations, or by fastening them with solder, a material of lower melting point. With the coming of the electrical era, the soldered joint became increasingly important, for it afforded a bond of high conductivity, easy to make and economical in space and cost.

The solders described in this article are called "hand" solders, or soft solders, because of the relative ease with which they can be melted. Wisely chosen many years ago on the basis of prior experience, they still remain excellent solders for their purposes. In recent years, steps have been taken to reduce the cost of the solder by lowering its tin content, and today a solder containing 33 instead of 45 per cent tin is recommended for the great majority of communication soldering operations.

Dissolving External Coating

There is no great art in making satisfactory soldered joints; fundamentally, soldering is merely the alloying of the solder with the surfaces of the parts to be joined. Most metals will alloy, at least to a limited degree, with the lead and tin which comprise the majority of soft solders. Any great difficulty that is experienced in soldering a joint is generally due to an external oxide or sulphide skin over the parts to be joined.

To dissolve and eliminate this coating, consisting usually of oxides and sulphides of the alloyed metals composing the parts to be joined, various "fluxes" have been developed. For many years a dilute solution of hydrochloric acid has been used. Later came the development of fluxes and solders which were especially adapted for particular purposes. For example, since many parts cannot be thoroughly washed and all traces of the flux removed after the soldered joint has been made because of the danger of injury to the insulation, the least destructive of fluxes, rosin, must be used.

Choice of Flux Important

In making the many soldered joints which are in close proximity to coil windings or insulation servings, unusual care must be taken in the choice of fluxes. Ammonium chloride, zinc chloride, and hydrochloric acid are highly destructive of both metals and insulations and cannot be used unless the nature of the apparatus permits thorough removal of the fluxes by neutralization and washing after the soldered joint is made. Consequently, rosin fluxed solder, conveniently arranged in tubular form, is widely used for communication apparatus, particularly in the field.

For untinned wire, which rosin does not clean sufficiently, naphthalene and tetrachloride, the least corrosive of the liquefied fluxes, may be used. Use of this flux is limited because of its high cost, disagreeable odor, and the necessity for careful removal of the excess flux and its decomposition products. The alcohol wash following its use must be done thoroughly and the alcohol changed frequently.

For these reasons naphthalene-tetrachloride flux is used only where a more corrosive flux such as soldering salts can-

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TABLE 1
Materials used for typical soldering jobs

Job	*Solder*	*Flux*	*Neutralizer*
General electrical connections in assemblies which cannot be washed.	45% tin—55% lead or 33% tin—67% lead	Rosin.	None.
Running seams on sheet metal (other than lead and its alloys).	45% tin—55% lead or 33% tin—67% lead	Soldering salts. (Ammonium chloride and zinc chloride.) Naphthalene. Tetrachloride.	Cyanide wash, hot water wipe or alcohol wash.
Copper, brass, phosphor bronze, nickel silver, tinned and untinned sheet.	45% tin—55% lead or 33% tin—67% lead	Soldering salts. (Ammonium chloride and zinc chloride.) Naphthalene. Tetrachloride.	Cyanide wash, hot water wipe or alcohol wash.
Galvanized iron sheet.	45% tin—55% lead or 33% tin—67% lead	Soldering salts. (Ammonium chloride and zinc chloride.) Naphthalene. Tetrachloride.	Cyanide wash, hot water wipe or alcohol wash.
Wiping and soldering lead joints.	40% tin—60% lead	Stearic acid.	Burning.
Tinned parts that can be washed after soldering.	45% tin—55% lead or 33% tin—67% lead	Naphthalene. Tetrachloride.	Alcohol wash.
Splicing copper wire where low electrical resistance and high strength are essential.	20% silver, 45% copper, 35% zinc*	Borax.	None.
Repairing brass castings where high strength is essential.	45% silver, 30% copper, 25% zinc*	Borax.	None.

*These are not what are generally termed soft solders, a torch being required.

not be thoroughly neutralized by a cyanide or citrate wash and where a non-corrosive rosin flux is not sufficiently active. Table 1 lists the solder, the fluxes and the neutralizing agent appropriate to typical soldering jobs encountered in communications work.

All metallic materials and even many non-metallic materials, such as glass and porcelain, can be soldered if properly prepared. Aluminum is alone among the commonly used metals in offering difficulty because of the extremely rapid formation of aluminum oxide which is unaffected by the usual fluxing agents. Unless this oxide coating is completely removed, it is impossible to obtain a satisfactory soldered joint on aluminum.

The best way to remove this coating is to clean the surface with some abrasive such as emery or sandpaper or dissolve it off with some powerful acid such as hydrofluoric or nitric acid. Immediately following the removal of this oxide the aluminum surface should be tinned with a solder consisting of zinc or aluminum alloyed with tin. Exhaustive investigations have shown that a solder consisting of zinc and tin, or consisting of zinc, aluminum and tin, is the most satisfactory for this tinning operation. Once tinned, ordinary lead-tin hand solders may be used for making the joint. In soldering aluminum, however, it must be remembered that all metals or combinations of metals are electrically electro-positive to aluminum and consequently are rapidly attacked and disintegrated when exposed to moisture. For this reason soldering of aluminum is not recommended.

Most alloys of lead and tin, indeed all those containing from 16 to 100 per cent of the latter metal, soften at about 358 degrees Fahrenheit. When used with any particular soldering iron the solder having the greater semi-plastic range will liquefy somewhat slower and will take longer to solidify completely than that having a lower range. For example, the semi-plastic range for the 45 per cent tin—55 per cent lead solder—is 114 degrees Fahrenheit; and the range for the 33 per cent tin—67 per cent lead solder —is 172 degrees Fahrenheit. It is obvious, therefore, that it will take slightly longer to make a soldered joint using the 33 per cent tin solder than using the 45 per cent tin solder. The recent developments in soldering irons have been along lines to increase their efficiency and to operate them at higher temperatures.

If two parts to be joined by soldering are to function under operating temperatures in excess of 358 degrees Fahrenheit, it is necessary that a solder having a tin content of less than 16 per cent be used, because any alloy having a greater tin percentage will begin to soften or become semi-liquid at this temperature. While soldered joints are not recommended for use at elevated temperatures, because the ultimate tensile strength falls off sharply with elevation of temperature, a lead-tin alloy having a tin content of 4 per cent has been found satisfactory for use under conditions where apparatus must function at temperatures within the semi-liquid range of the ordinary hand solders, and where very little stress is applied on the solder joints.

Compared with the metals being joined, soft or lead-tin solder is inherently weak, having an average ultimate strength of 4,000 pounds per square inch at room temperature. Therefore, since the ultimate tensile strength of the solder is low as compared with the metal parts to be joined, the joints must be of sufficient area to bear the stresses to which they are to be subjected and consequently lap joints are preferable to butt joints. At temperatures in excess of room temperature, the ultimate tensile strength begins to fall off rapidly because of the nature of the metals which compose the solder alloy, both of which show increased cold-flow, or creep, tendencies with an increase in temperature.

Since soft solder, like the lead and tin of which it is composed, offers very little fatigue resistance, it cannot be safely used for a joint which is subjected to fatiguing stresses.

Certain parts made of brass and other alloys are subject to season cracking. It has been found desirable to dip these parts in solder to eliminate the danger of season cracking. The heat of the operation serves to anneal parts, thereby removing any dangerous internal strains. In addition, the use of the solder provides a permanent protective coating to keep the surfaces from contact with the atmosphere.

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Although Universal has not as yet approved the use of the new reel, all of the other companies in the industry have recognized the economies and advantages of the new standard and are making the necessary changes in exchange vaults, shipping equipment, etc., to adopt the longer reel on April 1.

Sample reels meeting the standard specifications, with a 15″ diameter and a 5″ hub are being shipped to New York by the Council within the next few days for inspection and consideration of the New York distributing companies. Specifications and drawings of the new reel are being distributed to all reel manufacturers who will, between now

(*Continued on page* 29)

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THE new Supreme 391 P. A. Analyzer has been expressly designed, engineered and constructed to provide reliable facilities in one instrument for checking, testing and servicing every part of any type of sound equipment. Projectionists owe it to themselves to be familiar with its operation.

In order that space, weight and final cost should all be as low as possible, a single D. C. meter with associated rectifier was selected in place of separate meters for A. C. and D. C. measurements. The meter sensitivity was chosen so as to give a full-scale deflection with a current of 200 microamperes. This gives a readable deflection on currents of the order of 2 to 4 microamps or better, such as encountered in photoelectric cell circuits in theatre sound systems. These currents are easily read on the larger, wider angle scale used on the Supreme fan-shaped meter.

Meter Functions

The various uses to which the instrument may be put, as determined by the characteristics of sound equipment, include the following:

Measurement of direct currents, from photo-cell circuits to exciter lamp circuits.

Measurement of direct and alternating current voltages from the tube biases to high-voltage rectifier windings.

Determining of effective resistances from speaker voice coil windings to grid leaks and plate coupling resistors.

Measurement of capacities from small grid couplers to large by-pass and filter condensers of both electrolytic and non-electrolytic types.

Determining of the level of audio currents and voltages in their decibel relations to the accepted reference level.

These measuring functions must be available either for internal use in analyzing tube circuits and constants, or for external use, by means of test probes.

The currents to be measured vary in magnitude from a few microamperes to at least 10 amperes. Obviously, this great range cannot be covered by one meter without resorting to multipliers. Fig. 1 shows the basic current measuring circuit. R_m is the meter resistance, R_{se} is the series arm of the total shunt resistance R, R_{sh} is the shunt resistance portion of R, (i) is the current through the meter, and I is the current being measured.

By means of a multi-point switch, the proportion of R_{se} to R_{sh} is varied from 0 (R_{se} = 0, and R_{sh} = R) to several thousand, in order that I may vary from a few milliamperes to several amperes.

R_m is the total meter resistance, including a calibrated resistor in series with the actual moving coil so as to raise the combined resistance to a predetermined value, thus allowing the other circuit constants to remain fixed.

Voltage Measurements

D. C. Voltage. This highly sensitive meter is readily adaptable to the measurement of low and high D. C. voltages, by using proper series multipliers for absorbing that portion of the voltage which is not required across the meter.

Desiring a resistivity of at least 1000 ohms per volt, and with a low range scale of 0 to 5 volts, we find our circuit resistance, including the meter resistance, to be 5000 ohms, and the circuit current to be 5 ÷ 5000, or 1 milliampere. But, one milliampere will produce a 400% overload on the meter, hence it is shunted by a resistor of ¼ the meter resistance.

A. C. Voltages. A rectifier must be used when measuring A. C. voltages. The current will still remain at 1 ma. for full-scale deflection, with a 1000-ohm per-volt sensitivity. However, because the wave form of the rectified A. C. is such as to give average rather than R. M. S. values, the meter shunt resistor will have to be increased by an amount sufficient to allow a rectified current of approximately 1.11 x 0.2 ma., or 0.222 ma., through the meter for full-scale deflection.

It is unfortunately a fact that the rectifier resistance varies considerably with the amount of current passing through it. Hence, in order to have true readings resort would have to be had to a special meter scale which would compensate for the rectifier resistance variations.

However, by inserting a capacitor in series with the rectifier, and using its reactance for a multiplier, we will have a resultant current which is but slightly affected by the rectifier resistance, inasmuch as the drop across the resistance is in quandrature with that across the capacitor. Hence the evenly divided meter scale may be retained, as the current through the capacitor is proportional to the voltage.

A capacitor is also used for the 25-volt range, and here, because of the higher reactance of the capacitor, the rectifier resistance variation has even less effect. On the ranges above 25 volts, straight resistance multipliers are used, inasmuch as the change in total resistance due to rectifier resistance variations is only a fraction of a percent at the worst.

Resistance Measurements

For assisting in locating possible sources of trouble in sound equipment, it was considered necessary to include means for checking effective resistances ranging from a few ohms to many megohms. If a d. c. source of voltage were used, it would necessitate external batteries to make the higher ranges available. However, by utilizing the meter in combination with the rectifier, it is found possible and feasible to supply the necessary voltage from an inbuilt transformer.

The method consists of applying a known voltage to the unknown resistor in series with the meter and rectifier, and noting the meter deflection. A source of 2 volts is used to measure all resistors up to 500,000 ohms. Above this value the voltage is increased in order to produce a sufficient current through the higher resistance to give proper meter deflections.

Fig. 2 shows the basic circuit. E_{ac} is the source of voltage, R_s a series resistance to balance the meter circuit against the unknown resistor, R_x. If R_x is 0, or the terminals are shorted, full scale deflection will be had, indicating zero ohms. When there is any resistance at R_x, the meter deflection will be depend-

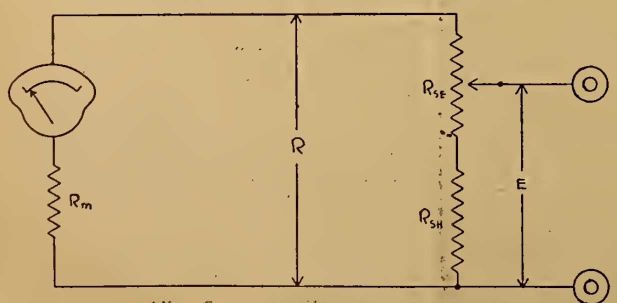

FIGURE 1

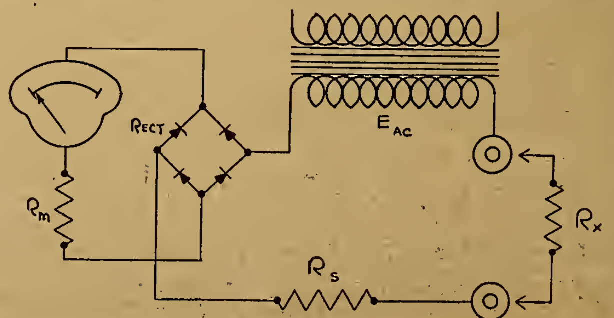

FIGURE 2

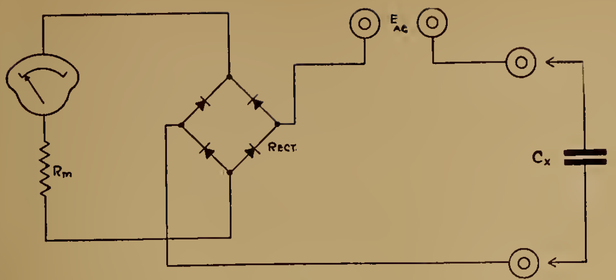

FIGURE 3

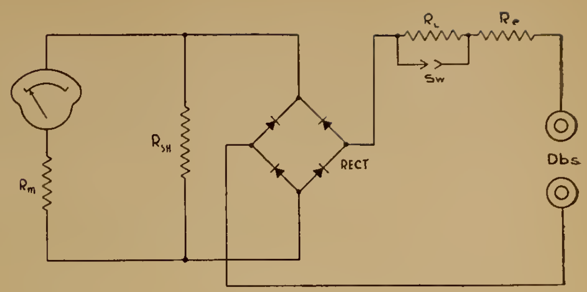

FIGURE 5

ent upon its value, hence can be calibrated directly in ohms.

Capacity Measurements

Sound equipment also embodies capacitors whose value is often desired. Again utilizing the source of A. C. voltage, and placing the unknown capacitor in a series circuit, as shown in Fig. 3, the meter deflections will be dependent upon the value of the capacity. For different ranges, a different E_{ac} is used so as to obtain satisfactory meter deflections for any capacitor in that range.

For the higher values of capacity—that is, those larger than 0.1 mfd. or so—the currents through the capacitor become too large to be passed through the meter, hence the meter is shunted. Also, a tapped shunt is provided ahead of the rectifier so as not to overload this device. Fig. 4 shows the basic circuit. E_{ac} is limited to 10 volts so as not to damage high-capacity, low-voltage, electrolytic by-pass capacitors.

Decibel Measurements

Facilities are provided in this 391 tester for direct measurement of the power level in decibels in a 500-ohm line up to plus 35 DB with respect to the accepted zero level of 6 milliwatts.

Essentially the circuit is, as shown in Fig. 5, similar to an A. C. voltmeter circuit. Resistors R_1 and R_2 limit the current to acceptable values for satisfactory meter deflections. The meter, however, has a portion of its scale specially calibrated in decibels, obtained by calculating the meter current flowing when the test probes are across a 500-ohm line, with a given power level therein.

A chart showing actual line DB's in terms of meter DB's for various common line impedances, accompanies each Model 391 Tester.

Tube Circuit Analyzing

All amplifier tube circuits can be accurately checked by the point-to-point method. Any tube, including the new metal types, is removed from its socket and put into the proper socket on the tester panel. The analyzer plug on the end of its multi-conductor cable is placed into the vacant tube socket, thus

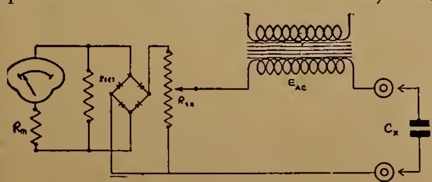

FIGURE 4

bringing all the tube circuits to the tester, where the current flowing through any element, or the potential of that element to any other element, can be readily read. Also, while the tube is in the tester, its condition can be instantly determined by means of the grid-shift method.

Checking Photocells

Photo-electric cells may be checked in two different ways: (1) By inserting the microammeter directly in one side of the cell circuit, the current flowing can be ascertained both with the cell dark and with full illumination. A good cell shows a considerable difference between the two readings, the exact amount depending upon the type and make of cell; or (2) with a frequency reel running through the projector and the Decibel meter connected to the output line of the amplifier, exact decibel differences between cells can be obtained by noting the output for equivalent portions of the film, all other variables and control settings being the same.

Battery-charging and tungar bulb rectifiers can be tested by inserting the d. c. ammeter in the top clip lead of such rectifier bulb.

By using the frequency reel which is furnished as a separate accessory to the 391 tester, the overall frequency characteristic of the entire sound system in a projection room can be obtained. The Decibel meter is connected to the output line, and the readings for each frequency are noted. The results show the variation in response for the different frequencies directly in DB.

Using this same set-up, the image of the light slit in the optical system in the sound head can be accurately adjusted. As the frequency film is running through the projector the optical system is continuously adjusted to give maximum meter readings for each frequency, and is then locked in position after obtaining the maximum decibel reading on the highest frequency.

Various Controls

By means of a rugged seven-position rotary switch, the meter is connected into its various circuits so as to be available for the several measuring functions cited previously. The rectifier and the various shunts are automatically connected when this switch is rotated.

A six-position range selector switch makes it easy to instantly select any range of the meter for any of its functions except the Decibel ranges. The latter are controlled by a two-position toggle switch.

A line-adjusting switch is provided, connecting to the tapped primary of the inbuilt transformer which can be set for any line voltage from 98 to 125. Adjusting this is accomplished quite simply by putting the meter in the "OHMS" position and depressing the "Zero Ohms" switch. If the meter does not show zero, adjust the line adjusting switch until it does. Proper voltage is then being delivered to the different circuits for the various measurements.

The meter is properly protected by a high-speed fuse, replaceable from the top of the panel; and the rectifier is protected against surges by a normally closed switch "shorting" it out until the operator is ready for the actual measuring.

The 391 has been especially designed for use in the theatre. It is simple in operation, yet it completely and easily makes all tests and checks necessary for 100% excellent sound equipment operation. The projectionist can operate it himself and keep his own equipment in shape.

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XVI Western Electric Power Unit, TA 7276

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The other three outputs of Fig. 1 are very thoroughly filtered, since the current drawn from them is associated with the photo-electric cell arrangements or with the early stages of amplification, hence ripple in that current would be amplified and show up in the speakers as hum. One of these three circuits lights the filaments of the 64-type tubes in the W. E. 41 or 46 amplifier. Each of the remaining two output circuits performs a double function, lighting both the filaments of the tubes in a photo-electric cell amplifier, and the filament of the exciting lamp.

The 4-ampere, 8.5-volt exciter lamp is not used in projectors supplied with power through Fig. 1, inasmuch as the voltage output of that rectifier is rather too high, and its current output a trifle too low. The 9-volt, 2.15 exciters are substituted.

The power input to Fig. 1 is shown at the top center of the drawing, and is 110 volts a. c., 50 or 60 cycles. It enters the rectifier through a double-pole switch, D-1, and completes its circuit through the primary of the rectifier's power transformer, which is tapped to permit adjustment for any line voltage between 100 and 125 volts.

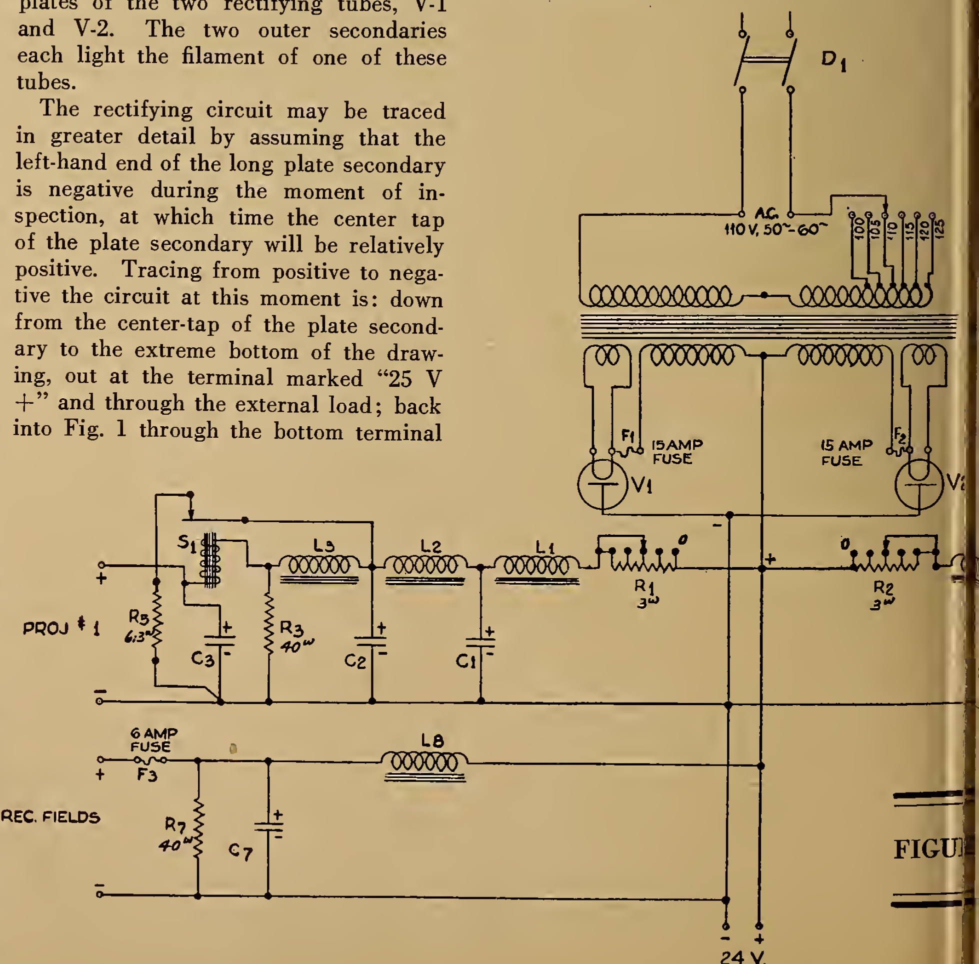
The Rectifying Circuit

Three separate secondaries are provided on the power transformer. The long, center secondary supplies the plates of the two rectifying tubes, V-1 and V-2. The two outer secondaries each light the filament of one of these tubes.

The rectifying circuit may be traced in greater detail by assuming that the left-hand end of the long plate secondary is negative during the moment of inspection, at which time the center tap of the plate secondary will be relatively positive. Tracing from positive to negative the circuit at this moment is: down from the center-tap of the plate secondary to the extreme bottom of the drawing, out at the terminal marked "25 V +" and through the external load; back into Fig. 1 through the bottom terminal marked "24 V —" and up and left to the plate of V-1. The plate of V-1 is thus wired to the positive center-tap of the secondary, while the filament of the same tube connects, through the fuse, to the negative left-hand side of the same winding. Hence, circuit is closed in the tube, and may be traced through the tube and the fuse, F-1, back to the transformer.

Tracing from negative to positive, as the electrons move, the circuit is: from the negative end of the secondary to F-1, to the filament of V-1, by emission across the space of that tube to V-1 plate; right, down and out at the 24-volt negative terminal, in at the 24-volt positive terminal, and up to the more positive center-tap of the transformer.

At the same instant, the extreme right-



FIGU

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That plate being more negative than the filament of V-2, electrons emitted in that tube are not attracted to the plate (closing the tube circuit) but are repelled by the plate and attracted back to the filament they have just left. Hence there is an open circuit in the right-hand side of this rectifier, and the only current flowing through the output terminals during the instant now under consideration derives from V-1. The direction of flow of that current, as seen, conforms to the polarities marked at the bottom output terminals of the drawing.

The Next Alternation

At another instant, when the a. c. polarity in the transformer secondary has reversed itself, the left-hand end of that winding will be positive. During that interval the plate of V-1 will be negative with reference to the filament of V-1, electrons emitted by that filament will be attracted back to it and repelled by V-1 plate, and the open-circuit just traced will have been transferred to the left-hand side of this rectifier. At the same time, current will flow through V-2, the plate of which (connected through the external load to the transformer center-tap) will be positive with reference to V-2 filament.

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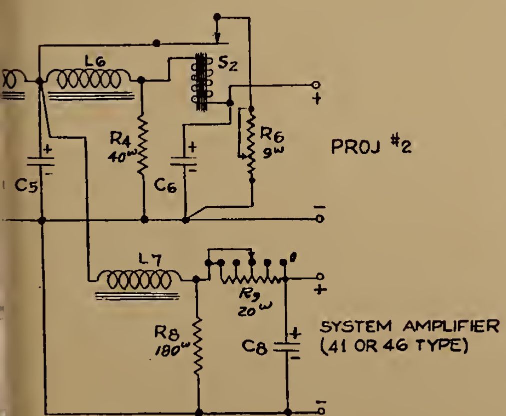

right to the plate of V-2, thence (that plate being positive) to the filament of V-2, and through the fuse to the transformer. During this half of the cycle also the flow of current through the output terminals conforms to the polarities shown in the drawing.

Consider a moment when the polarity of the transformer is in process of reversing itself, and the entire secondary is at neutral voltage. During that instant of time there is no flow of secondary current at all, and no charge upon the plate of either tube. Electrons emitted in the tubes are neither drawn to the plates nor repelled from them; some few may strike against the plates by chance, constituting a trifling flow of current across each tube too small to be considered.

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At the next instant one of the plates becomes sufficiently positive to attract electrons, and current flow through the output circuit resumes. The amperage increases as the positive charge of the plate increases, attracting more and more electrons. After that charge has reached its maximum and begun to decline, the current through the output falls off, as fewer and fewer electrons reach the plate, until another moment is reached at which the transformer winding is at neutral voltage throughout. Again the output current falls to zero, to reappear again (still in the same polarity) as the plate of the other tube assumes a positive charge.

The current through the terminals marked plus and minus 24 volts therefore varies from zero to maximum 120 times a second (or 100 times a second if the power supply is 50 instead of 60 cycles).

Filtered Output Circuits

Such current cannot be used for most sound reproduction purposes, and in Fig. 1 appears only at the output terminals previously mentioned. For the sake of simplicity in tracing the rectifying arrangements by which a. c. is converted to d. c., the other, parallel, output circuits have been temporarily ignored. The arrangements already considered indicate, however, that the tube circuits may be considered as a source of d. c. which, though it fluctuates in value from maximum to zero, never reverses its direction of flow.

The positive terminal of this d. c. source is the center-tap of the transformer secondary, and the negative terminal the jumper between the plates of the two tubes. This fact is emphasized in the drawing by the addition of plus and minus signs midway between the two rheostats, R-1 and R-2. The output terminals at the bottom of the drawing are connected directly to the d. c. source, without intervening filters, and hence are subjected, as seen, to the full fluctuation of the current.

The other four outputs of Fig. 1 are distributed at the two sides of the drawing, and connect to the d. c. source through intermediate filters, consisting of inductance coils and condensers. The coils are in series with the line, the condensers connected across it. When the power switch of this rectifier's a. c. input is closed, and one or the other tube plates becomes positive, the condensers connected across the output line accumulate charges, robbing the line of current in doing so. The inductance coils build up fields, a process which opposes the flow of current. For these reasons current rise in the filtered circuits cannot keep full pace with the increase in the plate positive charge.

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In the more thoroughly filtered branches of Fig. 1 the current flow is sufficiently steady to prevent even a sensitive sound equipment distinguishing between it and the pure d. c. drawn from a battery.

Speaker Field Output Circuit

As previously stated, the least thoroughly filtered branch is the speaker field output, which is shown at the lower left-hand corner of the drawing. The two terminals there shown are marked positive and negative. Tracing backward from the positive terminal, the circuit runs right through the three-ampere fuse, F-3; right through the filter inductance L-8, right and up to the positive d. c. source at the center-tap of the transformer secondary. Thence along whichever half of that secondary is negative at the moment to the filament of the associated rectifying tube, through vacuum to the plate of the same tube, along the jumper between the two plates

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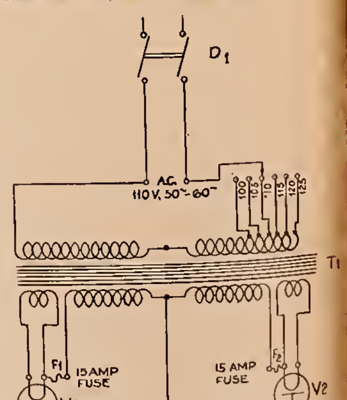

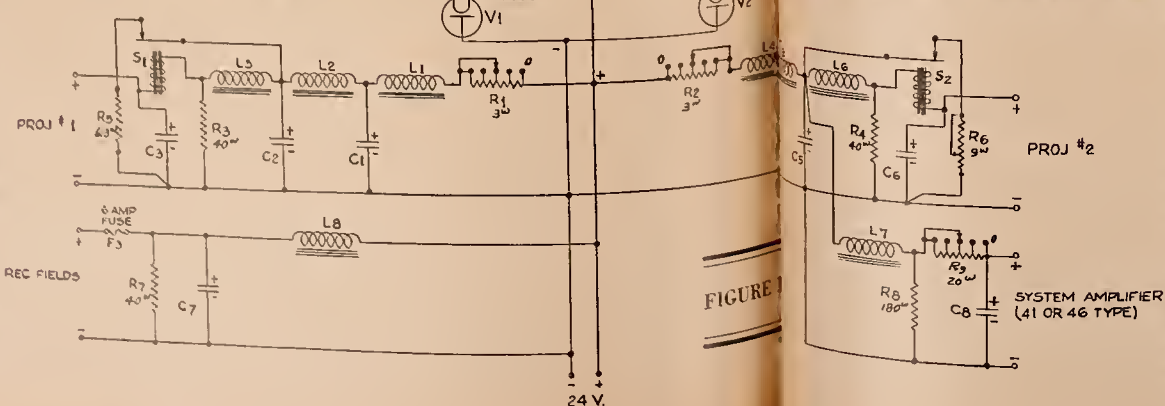

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to the negative bus, downward to the bottom of the circuit and left to the negative output terminal in the extreme left-bottom of the drawing.

Just to the left of the filter inductance, L-8, is condenser C-7, which is associated with that inductance in the filter action. To the left of C-7, and the left of the terminals marked "Rec. fields" (receiver, or speaker, fields) are other filter inductors, not shown in the drawing—namely, the windings of those fields themselves.

The "Bleeder" Resistor

The so-called "bleeder" resistor, R-7, is drawn just to the left of the condenser terminals and serves to reduce the voltage across the output. It could not do this if the d. c. source were of infinite power, able to supply an unlimited number of electrons to the output. Connection of a 100-volt lamp across a powerhouse line does not measurably reduce the voltage of that line. But connection of a load across the output of a generator of relatively limited power will reduce the generator output voltage, the rush of current through that load representing, to a degree, a "semi-short" across the generator.

In the case of Fig. 1, the d. c. output is limited to the number of electrons emitted in the tube that is functioning at the moment and reaching the plate of that tube. Consequently, bridging of the output line by R-7 represents a deflection of electrons from the output terminals, and a measurable, though small, reduction in the output voltage. This bleeder, moreover, keeps that circuit closed at all times, and hence acts to prevent an excessive voltage rise in the other output circuits in case the speaker load is for any reason open-circuited.

Circuit to Projector No. 1

The rectified output to the exciter lamp and photo-cell amplifier filaments of No. 1 projector is shown at the upper left of the drawing. Tracing from the positive terminal at the center-tap of the transformer secondary, this circuit runs down and then left to rheostat R-1, of 3 ohms impedance. The current flowing through the rheostat is 2.15 amperes for the exciter, plus .3 amperes for the tube filaments, or approximately 2.50 amperes. This current, multiplied by 3 ohms, gives a maximum voltage variation of 7½ volts, which R-1 is capable of introducing into the projector supply.

The slider of the rheostat is closed to one side of the winding to prevent complete opening of the circuit in the event of poor contact and to minimize arcing at the contacts, the resistance remaining always in parallel to any arc that may form.

Continuing from right to left, the line runs through filter inductors L-1, L-2 and L-3, thence down through S-1 and out at the positive terminal. Back in at the negative terminal and right and up to the jumper connecting the plates of the tubes, which is the negative side of the d. c. source. This line, as traced so far, is bridged by the filter condensers C-1, C-2 and C-3 and the bleeder resistor, R-3.

The Protective Relay

As the drawing stands, the circuit just traced is open at the projector switch. A branch circuit consequently exists, beginning at the junction between L-2 and L-3, and then running up, left, through the hinged contact and the arrowhead, and then down through R-5 to the negative side of the line. But when the projector switch is closed at the sound head, current flows through S-1, which acts as a magnet, drawing down the hinged contact and open-circuiting the branch circuit through R-5.

If for any reason the projector circuit is reopened—whether by circuit trouble, failure of an exciter lamp, or switching off of the projector between reels—S-1 winding is deprived of current, the hinged contact recloses to the arrowhead above it, and R-5 constitutes a substitute load upon this output. Whenever the projector circuit is reclosed, S-1 operates as before, opening the line to R-5.

This arrangement prevents material change in the voltage to other outputs of Fig. 1 when the left-hand projector is switched on or off, or when its exciter lamp burns out. Without this precaution, failure of an exciter might possibly blow out tube filaments elsewhere in the sound system.

Output to Projector No. 2

The supply to Projector No. 2 is shown at the upper right end of the drawing, and is similar to, but not identical with, the circuit to the other projector. In place of two branches, one to the projector and one through the protective relay, this line divides into three channels.

Tracing from the positive source, the projector supply may be followed from the center-tap of the secondary down and right to R-2, which corresponds exactly with R-1. Thence right through L-4, L-5 and L-6, down through the relay S-2, and out at the upper right-hand terminal. Back in at the negative terminal an inch lower down, and left to the center of the drawing, thence up to the bridge across the plates of the tubes. The filter condensers C-4, C-5 and C-6 bridge this line, as does the bleeder resistor R-4.

It will be noted, however, that the protective resistor R-6, switched in or out of operation by S-2, does not correspond exactly with the protective resistor in the opposite projector circuit (R-5) but is of 9 ohms instead of 6.3 ohms resistance and is a rheostat capable of adjustment. The reason for this difference will be seen in a moment, after the remaining output circuit of Fig. 1 has been examined.

Output to System Amplifier

Returning to the junction between L-5 and L-6, a line will be seen running diagonally downward, right, down, right through L-7, right through rheostat R-9 and out to the external load; returning through the bottom right-hand corner of the drawing and thence left, up, left and up to the jumper across the rectifier plates. This branch circuit supplies 3/10 amperes to the filaments of the 64-type tubes in the system amplifier. The rheostat R-9, carrying 3/10ths ampere through a maximum of 20 ohms, permits as much as 6 volts variation in the output supply, which is therefore equally suited to two 1-volt filaments in series, in the 46 amplifier, or to three such filaments in series, in the 41. The filter condenser, C-8, and the bleeder resistor, R-7, bridge this line.

The entire line just traced, however, bridges across condenser C-5, and therefore constitutes a bleeder upon the output to Projector No. 2. Consequently, to equalize the voltage to the two projectors, R-2 will be set for slightly less resistance than R-1. Moreover, R-6, the protective relay resistor at this side of the rectifier, is also adjustable and can be set either to match R-5 or to allow for the drain of the system amplifier filaments.

S. M. P. E. Projection Group Approves Double Reel

The Projection Practice Committee of the S. M. P. E., at its last meeting, approved the Academy specifications for a standard double reel, the diameter of the reel to be 15 inches instead of the 15½ inches originally proposed. The new film lengths, when introduced on April 1 next, will be at least 1750 feet long, less than which would make possible doubling in some of the larger theatres whose magazines can accommodate 3450 feet of film.

The Committee's approval was, in effect, merely a reiteration of double-reel specifications included in its own report of two years ago.

Loew's, Inc., Profits Jump

Loew's, Inc., reported net profits of $7,579,743 for the fiscal year ended Aug. 31 last, according to financial statement just issued. Dividends paid on the preferred totalled $888,530 and on the outstanding common stock, $3,316,737. Loew's, incidentally, recently took the lead in notifying L. U. 306 of N. Y. City of the "necessity" for a straight 41% wage cut.

Servicing Situation Acute; Prompt Action by Craft Vitally Necessary

Electrics give every indication of expanding, rather than restricting, scope of servicing work to include all projection equipment and general theatre service. Projectionist service record to date favors craft. Extension of craft servicing vitally necessary. Immediate action urged.

By JAMES J. FINN

SOUND system servicing still is a topic of absorbing interest to projectionists—to read about and talk about, but not to act upon. One can count upon one's fingers the number of projectionist organizations that have made a really serious effort to engage in servicing work. Of course, servicing can always be relied upon to provide an engaging topic of much big talk (if no action) at a Local meeting or down at the corner restaurant over a cup of coffee. But that's all.

This despite the fact that this publication has repeatedly pointed out the manifold dangers to the welfare and security of the craft of sound servicing work as at present conducted. Many brave words were uttered at Local meetings about the vital necessity for immediately engaging in servicing operations, but we fail to see any concrete results stemming from this flow of language. It is just a lot of guff, that's all; and if there be any craft more proficient in the distribution of this commodity than are projectionists, it has escaped the notice of the writer.

There can be only one reason for the present inactivity of the craft with respect to sound system servicing: the craft evidently believes that a few squawks uttered in these columns, plus a bit of flag-waving from various meeting-hall rostrums, has thoroughly intimidated the electrics and caused them to abandon for all time their plans for extended servicing.

Electrics Interest in Projection

Such notions are miles apart from the realities of the situation. Instead of curtailing their servicing activities, the electrics have actually expanded them. The latest bulletin issued by one of the electrics to its field forces is devoted *exclusively* to projection arc lamps—types, carbon trims, operating characteristics, repair requisites, adaptability to given sizes and shapes of theatres, and the like. Incidentally, this bulletin follows another that was devoted *exclusively* to screens, in the course of which was given more information than most projectionists could be bothered to absorb over a period of ten years.

Now, if there was some slight excuse for projectionist indifference to the inroads of the electrics with respect to sound system servicing, what has the craft to say to this latest manifestation of a greatly expanded servicing set-up by the electrics? Probably nothing, except possibly a few hundred more resolutions which will be faithfully recorded by the secretary and then promptly forgotten.

Quoting from the aforementioned servicing bulletin: "It is not intended that such applications of the data arouse any antagonistic relations, and it was taken for granted that you would so conduct yourselves as to avoid any complications . . . " Obviously the projectionist craft is to have its throat cut while it sleeps. Will it ever awake?

The bulletin proceeds further: "Following the instructions given in this issue and using two theatres as tests, the writer has successfully increased the light on the screen in one case over 35%, and in the other over 20%." This leads naturally to considerable speculation as to just what the projectionists in those theatres were and are doing to hold down their jobs and earn their pay. We know of no more important aspect of the projection process than some concern on the part of the projectionist about the measure of screen illumination obtained.

I. P. has never presumed to be the spokesman for the organized craft, but, reverting to the aforementioned sound company bulletin which is loaded with straight projection data, we hazard the opinion that any Local that permits a sound company man to work on visual projection equipment should promptly hand in its charter. It is bad enough to have them work with tools on sound equipments.

The blame for the development of sound servicing by the electrics as practiced today rests with projectionists and supply dealers. Wholly understandable was the attitude of projectionists: nobody prodded them, things were going along all right and evidently would continue that way indefinitely, they were paid off every saturday night, and everybody was quite content with the state of the world. Dealers were situated differently, because if they didn't sell replacement parts from day to day, the result was easily apparent in the sales sheet at the end of each week.

Supply Dealers' Delinquencies

No group has done more yelling about sound servicing work by the electrics than the dealers. They shouted that their rights were being trampled on, their functions usurped and their means of livelihood dissipated. They charged that projectionists were indifferent to the many years of service rendered them on supplies and repairs at all times of the day and night; they held protest meetings; they issued bulletins; they sought support from their manufacturers, and they wrote letters to the trade papers. But they had hardly ever moved out of their offices to get any business—and they got none.

Even before the introduction of the blanket repair and replacement part contracts by the electrics, supply dealers

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'No Comment' By Sarnoff on Erpi-RCA Truce

Asked to comment on reports that Erpi and RCA were negotiating a settlement of the pending lawsuit by the latter to expand its recording and reproducing activities in the sound picture field, David Sarnoff, head of RCA, said that he had no comment to make at this time. The trade generally interpreted this statement as a denial of settlement.

Reports of a settlement between Erpi and RCA first appeared in I. P., which reiterates its belief that a settlement not only is in progress but that its terms have been tentatively agreed upon. "Nothing to say" is a far cry from a denial, as I. P. sees it.

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were sadly deficient in rendering service. They bought tubes, for example, as they were ordered, hardly ever having more than six on hand. The same was true of various other sound system accessory parts—photocells, tungar bulbs, exciter lamps, and so on right down the line. If a theatre ordered a batch of tube replacements, the dealer in turn ordered the exact number required. Stocks were limited strictly to the actual demand within a period of a given week. Dealers never sallied forth from their offices to explain to their customers the hooey inherent in the electrics' parts contracts. They were too busy protesting.

Today the sound system replacement part business of supply dealers—all of them—is practically non-existent. And how they yell about it. Blame was promptly affixed, and has stuck to the projectionist; but this worthy was so busy thinking about nothing at all that he had no time to consider the problems of the dealer, often a brother organization man, nor to realize that the continued existence of the supply dealer added another element of strength to his own position.

I. P. has not escaped the deluge of letters-to-the-papers unloosed by supply dealers. One of recent vintage criticizes this publication's "nice treatment" of RCA, by contrast to its asserted rough handling of Erpi, by citing the recent deal whereby RCA is enabled to offer for the first time a complete visual and sound projection installation as another indication that RCA is just as sinful and hoggish for business as Erpi. What, demanded the dealer correspondent, had I. P. to say now about this company which it had been at such pains to omit from its severe indictment of sound company servicing.

The answer to which is simple. I. P.'s opposition to extended servicing work by the electrics was based on the fact that these companies used their sound system servicing contracts as a means of expanding the scope of their influence in this field. I. P. held that these contracts were just so much hooey to begin with, in that they called for an unwarranted number of service calls at inflated prices. Still, while exhibitors showed no disposition to object thereto, and the electrics showed no disposition to use these documents as a means for expanding their theatre interests and thereby treading upon projectionist toes, I. P. was content to let matters stand as they were.

When the electrics sought to use these servicing contracts as a wedge into what I. P. considers straight projection work, however, a different situation entirely arose, a situation akin to one wherein a lamp manufacturer not only sold his product to a theatre but also demanded a contract calling for fancy prices to service the complete room installation. On the other hand, if a certain John Jones desires to go into the equipment manufacturing or supply fields and offer a complete line from the carbon to the screen to the sound installation, I. P. cannot say him no.

There is no denying the fact that sound system servicing by the electrics had its roots in the situation wherein projectionists knew nothing about an element of the projection process which suddenly became all-important on the job which they were paid to do. I. P. never cited the 20,000 projectionists in America as a group of outstanding sound technicians, nor has it attempted to explain away the many obvious shortcomings of the craft relative to efficient sound system operation.

Electrics Learning Fast

But sound pictures have been with us since 1927. If the craft as a unit has not produced sufficient competent sound service men during the period from 1927 to date, then I. P. holds that the craft should get off the road and make way for somebody who knows where he is going and why. I. P. believes that just the reverse is true, and that the craft has ample capable manpower to do a good job of sound system servicing. The numerous localities where the craft has moved in and taken over work of this character is positive proof of this contention. Through the years the electrics have maintained that projectionists knew very little about sound equipment. We doubt the accuracy of this statement today. However, the electrics are in precisely the same position today with respect to visual projection equipment that the craft was in in 1927 with respect to sound equipment. With one important difference: they are learning fast—much faster than the craft learned about sound equipment.

It is an axiom of the craft that there is no substitute for practical, everyday experience in the development of a good projectionist. The art of projection certainly is not to be learned by even the most intensive application by sound company service engineers to the projection bulletins now being turned out by their employers. But—these engineers are both reading and working: they are getting theoretical experience through their reading, not only of bulletins but of every available writing on projection, and they are getting practical experience through their daily service routine in theatres where the projectionists are chumps enough to let them peel off their coats and go to work with tools. And they are learning fast.

In view of the extreme complacency with which this development has been received by the craft, it is alright with I. P. if the electrics go the limit and supplement their servicing work by offering a projectionist employment service. I. P. is privileged by reason of long and faithful service (like any good field dog) to voice some pretty harsh truths about the craft; and the craft invariably recognizes the truth of these statements and resolves to do better—but never does. But I. P. has not yet been granted the right to grab a baseball bat and go to

(*Continued on page* 22)

$21,000—For What?

NUMBER one among those things that are supposed to be the matter with the motion picture industry is ably presented in the appended editorial written by Charles ("Chick") Lewis, editor and publisher of *Showmen's Trade Review*, an honest trade paper and one that is not afraid to express an opinion on vital industry problems:

Still A Strangle Hold

The grip that the electrics had at the throats of the exhibition field by reason of sound and talkies, has never relaxed with but few exceptions. Erpi continues to believe that the theatreman cannot do without them.

To what extent they have cut into the meagre grosses of the theatre can best be described by pointing out that two 600-seat theatres paid to Erpi the staggering total of $21,000.00 over a period of three and a half years. And all the theatre has to show for that terrific sum is an antiquated talkie plant that should have been brought up to date years ago.

How they get around the various state laws on interest charges and financing is a source of wonder to many. On an equipment supposed to cost for cash, $2195., plus a compulsory service charge for two years, which brings the grand total up to $3755., they tack on an interest and finance charge of almost eight hundred dollars if paid for over a period of three years.

All too many exhibitors, ignorant of changing conditions, are allowing the electric companies to continue to make such deals. Might we remind them that they do not have to have Erpi equipment to stay in business. There are other equipments just as good and a damned sight less expensive to be had. Ask us if you are in doubt.

Vol. 9, No. 5 NOVEMBER 1935

The IP EDITORIAL PAGE

The New Double-Reel Standard

All major distributing companies—except Universal, which likely will fall into line—have agreed upon April 1 next as the effective date for the introduction of the new double-reel standard. I. P. readers are very familiar with the technical aspects of the new standard, the development of which has been charted in detail herein. A few die-hards within the craft still are not satisfied with 2,000-foot reel lengths; but this is a matter for organization concern, rather than a job for I. P., and a circumstance which serves once more to indicate the utter lack of cohesion and unanimity on technical matters within organization ranks. Unanimity of craft action months ago, rather than present regrets, is the answer to this angle, ample advance warning of the imminence of double reels having been given.

Several questions anent double reels still remain unanswered. The Academy hopes to realize thereby annual savings of $500,000. A final checkup likely will reveal this figure to be closer to $100,000; and it is precisely this fact upon which is predicated Universal's objection to the plan as a move that is hardly worth the bother and expense involved. The projection process will be little affected by the new standard, since 85% of the country is now doubling.

I. P.'s present concern with double reels is based, first, upon the Academy's announced plan to limit costs on replacements of reels and shipping cases. The new cases will have to be considerably stronger and more durable than present ones. No samples having been submitted, I. P. must reserve judgment on this item. With respect to the new double reels, however, I. P. has a well-founded belief that no little trouble will ensure. The Academy intends to limit the cost of the new reels to something "less than twice the cost of present single reels." I. P. holds that this can't be done and still realize any advantage through introduction of a new reel length. Present reels are of such poor quality as to be wholly unfit for use. To approve a double reel, the cost of which will be less than twice the price of the single reel, will make matters worse, not better. I. P. will have to see these new reels before its O. K. is forthcoming.

Most important, I. P. is deeply concerned with arrangements for the mounting of reels by exchanges in localities where either the opposition of the craft or municipal ordinances force the continuing use of single reels. The plans for this work look well on paper; but in view of the known deficiencies of exchanges at present in discharging the relatively simple duty of normal inspection of prints, the plan shapes up as something less than wholly satisfactory. This miserable record of exchanges to date induces grave doubt that they will do a good job of attaching S. R. P. marks and leader in localities where single reels must be used. Here is something with which the Academy might well concern itself before April 1 next.

Overall, I. P. holds that double reels attained an importance not warranted by existing field conditions. The record shows that neither the producers, nor the Academy, nor the Hays office exhibited any great interest in making effectual the single-reel standard. Must we look forward to the same disinterestedness with the double-reel standard? The longer reel length admittedly is an attempt to effect economies through film savings, in addition to smoothing out the projection process. This being so, why did not the Academy and the Hays office adopt positive rather than negative means for eliminating the widespread evils of film mutilation? This writer recalls, when operating several theatres, the receipt of bills from exchanges for damaged prints. And he paid, too, when advised that failure to do so would result in a suspension of all film service. This course has long been open to the now solicitous producers, but they lacked sufficient courage to follow this road. Which means that worn parts and obsolete equipment will continue to chew up and scratch film, new standard or not. Why don't the distributors courageously exercise their indisputable right of control over their property, the print, by forcing Mr. Exhibitor to toe the mark on inferior equipment—the real core of the problem?

The S. M. P. E. and Practical Projection

The formation several years ago of the Projection Practice Committee of the S. M. P. E. was hailed by this publication as a highly desirable and beneficial move, providing the Society with a means for direct contact with the practical projectionist and offering an opportunity for the man in the field to become better acquainted with advanced engineering thought. There has been no stronger supporter of this Committee than I. P., which bestowed lavish praise upon this group and commended its work to the craft as an outstanding achievement of unselfish cooperation. Here was a group that was truly representative of the craft and acutely appreciative of and responsive to the needs of the practical man.

We regret to observe that this attractive pattern has changed considerably of late. Recent events indicate that there is very little practicality about the present Projection Practice Committee. It no longer can be considered as truly representative of the craft in that it no longer is headed by an outstanding projection man (which it certainly should be) and its scope has been drastically curtailed through the assignment elsewhere of work that properly lies within the domain of practical projection. We refer to the recent appointment of a special Society committee to look into the question of screen illumination.

Now, I. P. holds that if screen illumination be not a primary concern of a practical projection committee, then nothing is. We also hold that even as now constituted the Committee has ample capable manpower to provide a wholly acceptable answer to questions concerning screen illumination. Assignment of this work to some other group within the Society, composed of even the most eminent engineers, might result in some very pretty graphs and highly erudite conclusions, but we doubt that it will better serve the practical necessities of the situation than would a job by the present Practical Projection Committee.

Likewise with screens, a topic which presumably is receiving the sporadic attention of the Projection Screens Committee. If screen illumination and screens be not the proper concern of a practical projection committee, its only function must be to see that a projector, with the dowser down, is periodically oiled so that the mechanism will not stop. We suggest the appointment of a committee on negative carbons

(*Continued on next page*)

CRAFT INTEREST IN SERVICING NECESSARY

(*Continued from page* 20)

work on a craft that insists upon being destroyed by its own hand.

There is nothing magical, nor anything to strike terror into projectionists' hearts, about the electrics—other than the fact that they are well organized, they see their objective and they are steadily pushing ahead in that direction. Projectionist groups whether local or national, do a lot of talking about their organization, their cohesive spirit, but the effects of this beautiful set-up are not readily apparent to the writer in matters such as sound system servicing. Projectionists should drop the idea, if they hold it, that the electrics constitute some prize bogeyman, able to wave a magic wand and attain whatever goal they desire to reach. I. P. considers these big, top-heavy organizations like the electrics as mere pushovers for a craft as strongly positioned as are projectionists at present. Vulnerable the electrics certainly are, although one wouldn't think so to review the relations of projectionists and electrics during the past eight years.

Anytime projectionist organizations decide that they no longer wish the ceaseless horde of sound company service men to be traipsing in and out of projection rooms, working with tools and doing a first-class job of discrediting the projectionist with the boss—anytime the craft makes up its mind to be rid of this situation for once and for all, then at that precise moment it is all over with the electrics. That's how much of a bogeyman they are.

Electrical Worker Angle

It's about time that mention was made of something which to date has been a topic for backstairs whispering and considerable private conversation. In addition to the menace contained in the electrics' servicing policy, there are our dear, dear friends—the electrical workers. If projectionists think that there is any less danger in the electrical workers, with respect to servicing work, than there is in the electrics' policies, then they have another guess coming. Electrical workers have been after sound system servicing work for years, and they still are trying.

Projectionists may pooh-pooh this assertion; but we seem to recall a similar attitude on the part of the craft before the electrical group moved in and made a shambles of the Hollywood studios insofar as the I. A. was concerned. Thus, it's simply a case of choosing one's poison; and of the two, the writer would elect to take his chances with the electrics, who can hardly have developed to the same degree of perfection the technique of the electrical workers in moving in and throttling a craft with one swift lunge.

There appeared in these columns last month a short item that so perfectly illustrated the point of this article that is is reproduced here:

> **Local 327 Sound Service**
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> Local 327, Cincinnati, is now offering a sound and visual projection service to all exhibitor clients. Basis is two regular monthly calls, with emergency service as needed, all for flat rate of $15 monthly. Union emphasizes no-profit motive, desiring only to break even. Complete sound truck is used, parts being supplied at cost. One-third of exhibitors have signed. Ex-Erpi man, K. Pitts, is director of service, described by Union as helping members to become more proficient and aiding better understanding between Union and exhibitors.

Here is the perfect exposition of the servicing procedure as outlined repeatedly in I. P. Visual and sound projection; no-profit basis; free emergency service; parts at cost; a truck for speed; competent direction (the ex-Erpi man angle is swell, and there are many of them around on the loose) and last but certainly not least, the expectation, which undoubtedly will be realized, of better relations between exhibitor and Union, with the former to be tied-in even closer to the latter.

Now, the Cincinnati local didn't get off two- and three-page letters to this publication or anywhere else asking cooperation to a degree that was impossible of granting; in fact, they didn't even bother to supply the details of their plan when it became operative. They simply noted the servicing data in I. P., figured out their own plan of attack, and proceeded to execute it along precisely the lines laid down by I. P. It's a safe bet that many projectionist groups within a radius of 100 miles from Cincinnati still are unware of what is happening right under their noses. Or, worse still, even care.

To the assertion that the same plan is not adaptable to every projectionist organization, to the assertion that it can't be done for this, that or the other reason, I. P. has a stock answer: nonsense. How about Cleveland, where since the introduction of sound pictures not a service man has laid a hand upon a tool or touched a sound equipment, much less the visual projection unit? Cleveland's plan offers a certain number of service calls free, a charge being made only for emergency calls, as contrasted with the Cincinnati plan of a minimum monthly charge for both regular and emergency calls.

How about San Francisco, where the Local has been steadily gaining houses for servicing as fast as the electrics' contracts expire? Testing equipment purchased by the S. F. organization, on which a substantial deficit was anticipated, has actually netted the Local a handsome profit. The plan must be wholly satisfactory, otherwise additional exhibitors would not be tumbling over themselves to sign up with the Local. And there need be no doubt as to the goodwill value of these service-work contracts to the Union around contract time. Exhibitors were customers of the Union before they were customers of the electrics, and every possible effort should be made to keep them that way.

For the benefit of those whose memories are short, there are presented again

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Editorial (*Continued from preceding page*)

and another on positive carbons, joint sessions of which shall be held biannually.

The Practical Projection Committee was intended to be the projectionists' very own, the direction of which was to be in the hands of an outstanding projection man, and the scope of which should have been progressively enlarged rather than restricted. The last convention of the Society uncovered a studio personage who sought a simple answer to the question as to why he couldn't get 12 or 14 foot-candles through a print to the Music Hall screen when he had easily obtained as much or more illumination through the same print in the studio projection room. Twenty years of Society activity, with all its notable contributions to the art of taking and showing motion pictures, has failed to alter the fundamental requisites of practical, as compared with theoretical, cinematography.

We need offer no excuses for this comment to the present chairman of the Practical Projection Committee, because we know that he knows that we consider him one of the ablest technicians and swellest personalities in the Society. But he simply is not of the projection group, and that's that. Unless there is occasioned a drastic revision in the present outlook of Society officials upon the true character and proper functions of the Projection Practice Committee, the craft might well consider the advisability of forming and lending undivided support to a practical projection group of its own. There is no dearth within craft ranks of capable practical manpower, the activities of whom would reflect credit exclusively upon the craft.

the essentials of Union sound servicing, as culled from the files of I. P.:

"1. Charges to exhibitors.
"2. Existing service contracts.
"3. Assured competency.
"4. Proper service equipment.

"1. It seems pretty generally agreed within the craft that service work should be paid for by the exhibitor. As pointed out in these columns, the electrics cannot possibly afford to give service for nothing but must get a price that will be consistent with executive and field work overhead charges. Local unions certainly can underbid the electrics, however, no matter how low the latter's charges may be scaled.

"2. Existing service contracts are not a matter of primary concern on the part of local unions, except that their expiration dates should be carefully catalogued by the Union and overtures made to the exhibitor far enough in advance of expiration.

"3. Competency is something which needs no special emphasis herein, and the angle of proper service equipment ties-in nicely. The necessity for doing a good job, at least as good as done heretofore by the electrics, is taken for granted by all concerned. This consideration should offer no serious trouble to local unions, particularly in view of the fact that electrics' servicing to date has consisted largely of one call per week per theatre, or less.

Equipment No Secret

Projectionist organizations naturally would enjoy the added advantages of having constantly in the theatre one of their members who could cooperate with and aid the Union serviceman at every point.

"4. The very same equipment now used by the electrics' service engineers, about which there is no mystery and which is easily obtainable in the open market, could be utilized by the Local. In fact, the S. M. P. E. visual and sound test reel, prepared by projection men within the Society, is now utilized by the electrics and is available to anybody who wants it.

"One important consideration not previously discussed concerns the nature of the servicing agreement to be executed between the Union and an exhibitor. This publication advocates that servicing operations by a Union, wherever possible, be made an integral part of the Labor contract for the one- or two-year period, or whatever the term. In this way there would be no misunderstanding as to just what was expected from both Union and exhibitor."

Thus the requisites for the establishment of an efficient sound system servicing plan. Exhibitors should welcome such a plan as a relief from excessive service charges and an assurance that the responsibility for the installation, operation and care of their equipments would be concentrated in one quarter. Improved results are bound to ensue from such a set-up.

Whether this article will serve to bestir projectionist organizations from their lethargic outlook on matters of vital concern to their future welfare remains to be seen. It requires no seer to predict that the failure of the craft to take immediate action to protect their interests will result in disaster within a few years. Already the prestige of the projectionist has been dealt severe blows by the intrusions of service men, manufacturers' representatives and various other self-styled "experts" who have been trundling in and out of projection rooms unimpeded for years.

I. P. certainly has done its share in emphasizing the grave dangers confronting the craft in the form of servicing work as presently handled by the electrics. The question is: Will the craft finally snap into it and take appropriate action to not only prevent any extension of the electrics' influence but also to pare down considerably the amount of sound system service work now being done by sound companies? As previously stated, this answer is not I. P.'s to give, but must await the verdict of the craft.

The course followed by the craft in the next few months relative to this question of sound servicing will, this writer thinks, largely determine the future welfare of projectionists as craftsmen and as organization men. Frankly, the writer awaits this answer with little optimism. He hopes he's wrong.

Advance Publication Date of I. P. Sound Book

The publication date of "Sound Picture Circuits," originally announced as November 20, has been advanced to December 15 at the earliest, due to the tremendous rush of orders which necessitates a greatly increased press run. The delay is occasioned mainly by the fact that an unprecedented number of projectionist Local Unions availed themselves of the special pre-publication offer to purchase copies for their entire memberships.

Orders for this book, to be published by I. P., will be filled in the order of their receipt, thus the early buyers will receive the first copies published.

New DeVry Chain-Drive Theatre Projector

The new DeVry silent, chain-drive theatre projector represents the plan of its maker, Herman A. DeVry, not to enter the professional projector field until he had a real contribution to make in projector design. Among the more important features enumerated by DeVry for his new theatre projector are:

1. Integral engineering design for *both* sound and picture projection, rather than the addition of sound equipment to the projector. 2. The use of a silent chain drive instead of meshed gears—damping machine noise, smoothing out the film motion and greatly reducing the number of parts, always an important consideration in replacement and repair costs. 3. A patented synchronous framer that acts in harmony with the shutter, eliminating the possibility of faulty framing. Regular equipment includes a rear barrel shutter.

The new projector is handsomely streamlined in a dustproof metal case. It utilizes all the approved lamps, both arc and Mazda, while the amplifiers are powered for the largest theatres.

CHRISTMAS SEALS AND WHAT THEY DO

By A. SCHAEFFER, Jr.

Each year at this season I. P. publishes advertising and editorial matter relating to Xmas Seals, those tiny but mighty seals the price of which goes to alleviate the sufferings, and in many instances help effect a cure, of tuberculosis patients. I. P. is proud to help in its humble way in return for the great amount of good these Xmas Seals have done for the projectionist craft. Buy Xmas Seals.—*Editor.*

CONTINUING a custom that is now almost traditional in American life, Christmas Seals will appear again soon throughout the nation. From now until Christmas they will make their silent plea for aid for the tuberculous. For more than a quarter of a century the National Tuberculosis Association and its 2,000 affiliated units throughout the country have been waging war against this disease. They point out startling facts about it that deserve the attention of every one.

Although progress has been made in the fight, tuberculosis is still the greatest cause of death in this country between the ages of 15 and 45. The annual toll is approximately 70,000 men, women and children—more than twice as many persons as are killed in auto accidents. One and one-half times as many young women as young men between the ages of 15 and 24 are victims, an annual economic loss to the nation of nearly one billion dollars.

The work financed by Christmas Seal funds is varied, but it is all directed toward the discovery of unknown cases of tuberculosis, securing treatment for them, and educating the public in basic facts about the disease so they will know how to protect themselves from it. Education of the public is the fundamental purpose of the organization. The National Tuberculosis Association declares that if modern knowledge about the disease were properly applied by the public, tuberculosis could be wiped out almost overnight; all present deaths

(*Continued on page 27*)

• NOTES FROM THE SUPPLY FIELD •

IN THE last issue of I. P. (Oct., p. 21) announcement was made of a new G. E. Mazda lamp for the projection of 35 mm. motion pictures. The eminent M. D. O'Brien, ever-foraging assistant director of projection for Loew's Theatres, Inc., read the announcement and immediately got busy in an effort to obtain several of these new lamps.

To the great surprise and apparent discomfiture of Mr. O'Brien, he experienced no little difficulty in obtaining said lamps, and in the process of trying he heard several stories which reflected unfavorably on the accuracy of the I. P. announcement. General Electric was immediately called upon to unravel the tangled skein, one of their engineers contributing the following factual data:

"I have your letter in which you raise some additional questions regarding the 2100-watt 60-volt projection lamp recently announced. I can imagine that Mr. O'Brien might have encountered difficulty in finding this new lamp in stock, since it has so far been put in stock only where a demand for it exists. On the other hand, he should have had no trouble getting information regarding it from any of our various Sales Offices.

"Mr. O'Brien's information to the effect that development work on this lamp was stopped almost a year ago might be correct only to the extent that development work on the lamp has been *completed* within the last year. It is true that a different type of socket is required for the lamp, as was indicated both by the illustration which accompanied the description of the lamp as well as by the third paragraph of the text. Bipost sockets of the type used in airway beacons and similar applications have been available for some time, and a new socket designed especially with the requirements of motion picture projection in mind has just been developed by G. E. and will be announced shortly.

"The reported approximate price of the lamp is correct ($16) but I cannot refrain from remarking that in terms of lamp cost per hour it is lower in price than the 1000-watt, biplane-filament lamp now being used in semi-portable 35 mm. equipment. This is because the lamp is designed for a rated life of 50 hours; whereas the other biplane-filament types are designed for a rated life of 25 hours.

Dimensions of Lamp

"The dimensions of the lamp are such that the distances from the center of the filament to the bottom of the socket are not greater than the prevailing distances from the center of the filament to the bottom of the socket of existing types; and the distance from the center of the filament to the top of the bulb is only one inch greater than in the case of existing types. Therefore, with the possible exception of one or two equipments where space is extremely limited above the lamp, we have found it practicable to use it in existing equipments. Incidentally, DeVry and Holmes both have models available using this lamp.

"I trust that these comments will put your mind at ease on this subject as I do not believe than any erroneous information has been conveyed to your readers."

Thus, Mr. O'Brien's quest is rewarded, I. P.'s unblemished reputation for reliable reporting is sustained, and G. E. gets a really marvelous publicity break. However, they'll be billed just as soon as the aforementioned sale goes through.

New Condenser Catalog

A larger and still more varied line of condensers and resistors is featured in the 1936 Aerovox Catalog, just off the press, with several pages added over previous editions. In the strict sense, this is a new catalog, replete with added items and many revisions, so as to bring the entire line of electrolytic, paper, mica and other condensers, as well as several types of resistors, up to the anticipated 1936 standards and requirements. A copy may be had from local direct from Aerovox Corp., 70 Washington St., Brooklyn, N. Y.

Hawkins Data Incomplete

Decision as to the merits of the Hawkins Projector Safety Device, described in these columns last month (p. 20), was withheld pending receipt of additional data relating to the construction, hookup and operation thereof and to the basis for the assertion that its use would enable a 20% reduction in fire insurance rates on theatres adopting it.

Some information has been received, but unfortunately neither diagrams nor explicit insurance leads are included. This essential information has been solicited again, receipt of which is expected in time for the next issue. Meanwhile, the following has been culled from the manufacturer's statement:

"This equipment is intended for installation in the bottom part of the head of any projection machine, and on the wall of the projection room. It consists mainly of a centrifugal, electro-mechanical switch which acts to de-energize a control circuit by virtue of the centrifugal force of steel balls functioning at a subnormal speed of the film sprocket.

"It is designed to prevent fire and destruction of film in the projector . . . by shutting down the arc lamp and motor simultaneously in cases of subnormal speed."

Many requests for further information anent this device have been received by I. P., attesting to the great interest aroused in such a sharp reduction in insurance rates as the 20% figure cited by the sponsors. I. P. hopes to present complete details of this device in the next issue.

Television Remote, A. T. & T. Tells Federal Commission

Testimony that practical television still is "quite a distance in the future" was adduced recently at a Federal Communications Commission hearing on an A. T. & T. request for a re-examination of its petition to install a coaxial cable between New York and Philadelphia, states the Associated Press. F. B. Jewett, representing the telephone company, declared that the installation would be "a purely experimental project in its entirety."

The commission in July authorized laying of the cable, with certain restrictions, including one compelling A. T. & T. to allow the use of, and make available the results of its experiments with, the cable. Objections to this ruling resulted in the latest hearing.

RCA Interest in Cable

Mr. Jewett stated that RCA has approached A. T. & T. regarding the use of the cable for experimental television purposes and is conducting some field tests. He denied that RCA has any exclusive claim on the facility for television purposes. Asked whether the cable was designed primarily for television, he replied: "It would be an absurdity to spend the money primarily for television, which still is quite a distance in the future". The use of the cable for television will be small in the next ten years, he added.

To the question as to whether A. T.

(*Continued on page* 26)

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& T. would not hold all patents resulting from experiments with the cable (a typical telephone policy of amassing huge patent combines) Mr. Jewett said he was not qualified to answer.

As I. P. has repeatedly pointed out (July, 1935, issue, p. 9), every indication points to television by radio, instead of wire, and RCA has the radio rights neatly sewed up, with A. T. & T. completely blocked out of the picture except by wire. Hence the telephone combine's interest in coaxial cable.

NEWS OF THE MONTH

Canadian 'Electrics' Deal

Northern Electric, which has represented W. E., and RCA Photophone, both in Canada, have combined and in future will operate under the name of Dominion Sound Equipments, Ltd., with main offices in Montreal under the direction of O. R. Harvey, formerly with Northern. This combination will handle sales and services for both companies throughout Canada, with branch offices and depots already opened.

Head offices of both companies said that the Canadian tieup would not affect in any way the domestic activities of either company. Close observers opined that the Canadian deal presaged settlement of Erpi-RCA dispute in U. S., which has occasioned strained relations. Denials on this point from both companies are recorded here for what they may be worth.

L. U. 110 Autonomy

Nominations for officers of Chicgo projectionist Union Local 110 on Nov. 21 forecast early return of this organization to autonomous basis. Nominating session, the first meeting since the death in February last of ex-business representative Thomas E. Maloy, was directed by the I. A. Nominees are:

Business representative, Frank Clifford; president, Peter Shayne; vice-president, Glenn Sweeney, and secretary-treasurer, Neal Bishop The nominees being unopposed, their election on Dec. 5 is assured. A report of I. A. stewardship also was read at the meeting.

Dealers Report Gains

A 40% improvement in business over last year is reported by dealers attending the mid-year board meeting of the Independent Theatre Supply Dealers Association held in New York Nov. 21-24. A further sign of improved conditions is the report of dealer members that they have spent considerable sums in refurbishing their quarters, in adding new equipment and in expanding their service facilities.

Present at the meeting were: J. E. Robin, executive secretary; B. F. Shearer of Seattle, president; K. R. Douglas of Boston, vice-president; Clem Rizzo of Phildelphia, treasurer; J. C. Hornstein

of New York; George McArthur of Detroit; J. M. Graham of Denver and A. F. Morrone of Pittsburgh.

Par. Favors I. B. E. W.

Paramount recently demanded the resignation from the I.A.T.S.E. of all members of a crew going to New York to film scenes for "Thirteen Hours by Air" according to *Film Daily*. Local union heads were bewildered by the action. It was said in informed quarters that the move was planned to block union difficulties similar to those experienced by independent producers recently as a result of differences between the I.A.T.S.E. and I.B.E.W.

Canadian Duty Cut

The new trade agreement between the United States and Canada cuts from 35 to 5 per cent the duty on such motion picture equipment as arc lamps, screens, sound apparatus and equipment parts. It also reduces the levy on films for aerial photography from 15 to 10 per cent. Before agreement becomes effective it must be approved by the Dominion Parliament. President Roosevelt's okay suffices under broad powers delegated by Congress.

I. A. Ruling on 16mm.

All 16mm. projection jobs require the services of an I. A. man, it has been announced by the general office in a restatement of policy induced by the present greatly expanded number of such shows throughout the country. Sub-standard equipment is finding increasing favor with industrial and educational groups, many I. A. men now being engaged in countrywide tours. Character of showings does not affect I. A. ruling on manpower requisites, with no exceptions.

THE XMAS SEAL DRIVE

(*Continued from page* 23)

from the disease are totally unnecessary. Educational work is therefore unceasing and includes the distribution of literature and posters, lectures, radio broadcasting, the showing of motion pictures and lantern slides, exhibits and other devices.

Nursing service is frequently the major activity. Many associations conduct clinics at which tuberculin tests for children and chest examinations for adults are given. Tuberculin testing of children, which reveals whether tubercle bacilli are within the body regardless of whether active disease has developed, has assumed new importance in recent years. X-rays are given when the physical examination or tuberculin tests indicate the possible presence of active disease.

Rehabilitation work—assisting the tuberculous patient to discover his most productive activity and to secure adequate training in this field—is being given greater emphasis as a result of recent studies. Some associations maintain a preventorium. These are essentially hospitals which care for children who do not actually have tuberculosis, but who are in danger of developing it either because they are physically under par or because they live in a home in which one of the members has active tuberculosis. At the preventorium they are built up physically with good food, plenty of rest, and supervised activity that permits adequate exercise but prohibits over-exertion.

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tuberculosis associations during the year are a remarkable demonstration of the power of the penny, for it is all made possible by the sale of Christmas Seals for a penny each.

No 'Cure' Found Yet

There have not been wanting men and women who have ventured to try this, that and the other thing in order to short-cut nature's way of curing tuberculosis. Almost every known substance, mineral and vegetable, organic and inert, has been tried singly and in combination as a cure. Hundreds of attempts have been made to kill the tubercle bacillus, the deadly germ of this disease in the tissues of the body, but every attempt has resulted in failure. For the substance that would kill the living germ in the tissues also kills the tissues: the cure is much worse than the disease. Even salts of gold or sanocrysin, one of the latest remedies to be tried, has proved a failure, as have salts of all the baser and precious metals.

The germ of tuberculosis, once it lodges in the body, is well nigh impregnable to any chemical or similar substance now known to man. Honest scientific investigators who have tried and failed deserve great credit for their endeavors. To those quacks who have exploited the consumptive public with worthless nostrums and have preyed upon their weaknesses, no words of condemnation are strong enough.

The National Tuberculosis Association has in its files records of more than 1,000 different kinds of "cures" for tuberculosis ranging all the way from such perfectly harmless things as lemons, or possibly dog's blood, to the most absurd contraptions and devices that one

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could possibly think of. Every kind of inhalant or every kind of drug or combination that could be thought of has been tried, all without success. "Cures," or as the doctor calls them, "specifics" for the treatment of tuberculosis, are of no value. The only known cure for tuberculosis still is the remedy of fifty years ago—rest, fresh air and good food.

Today, as we carry on the work of the founder of the tuberculosis campaign in the United States and with the annual Christmas Seal sale promote a rational attitude toward the cure and prevention of tuberculosis, we are giving a new lease on life to thousands of men and women and we are hastening the day when tuberculosis will be brought completely under control. Buy Xmas Seals.

Major Companies To Adopt Double Reel April 1

(*Continued from page* 12)

and April 1, prepare to manufacture the new sized reels and cases.

For a period of time during the transition from 1,000′ to the new standard 2,000′ reels, the studios will cut each production so that a change-over may be made at the appropriate 1,000′ length throughout the picture, to provide for those few theatres which may not at present be equipped with 2,000′ magazines, and the few foreign countries throughout the world which for one reason or another are not able to accommodate releases on the 2,000′ reel.

It is contemplated that these 1,000′ change-overs will be necessary only for a period of approximately one year after the general adoption of the 2,000′ reel, until such time as all theatres throughout the world are equipped to handle the new standard. At this time all provision for change-overs at the end of the first 1,000′ of each reel may be discontinued, as the two sections will be spliced together, and throughout their life all

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prints will remain a unit. At that time it will thus only be necessary in the studio to find a change-over at the end of what now corresponds (with the presently used 1,000′ reel) to reels 2, 4 and 6.

In order that the majority of theatres which receive their prints on 2,000′ reels will not, during this transition period, be given false change-over cues in the middle of the reel, the Research Council has recommended that those exchanges requiring non-standard 1,000′ reel releases break the print down into approximate 1,000′ lengths, placing appropriate change-over marks at the correct positions on the reel ends by means of a stylus and stencil which may be provided for the purpose. Appropriate head and tail end leaders placed on the ends of the 1,000′ sections will complete the alteration of the standard 2,000′ reel of film for distribution on non-standard 1,000′ reels.

As an alternate method, it is proposed that the laboratory make up a dupe negative of the last 12′ of the first section of each reel, which may be punched to provide appropriate change-over cues, and that a small number of prints made from this dupe negative in combination with the appropriate run-out leader be supplied for splicing to the end of the first section by those exchanges which must release film on non-standard 1,000′ reels. A head end leader may be supplied to the exchange to be spliced to the beginning of the second section of each reel to complete the preparation of non-standard 1,000′ reels by this method.

Several Problems Remain

Thus the production and distributing (exchange) requisites.

On the projectionist and local ordinance fronts there still remain a few obstacles to hurdle. Several projectionist organizations have failed to evidence any great enthusiasm for the longer reel (notably Boston); and there are a few cities where the local code will have to undergo drastic revision before the decks are cleared for double reels.

In New York, for example, the fire authorities evidently intend to trade acceptance of double reels for a general tightening up of film storage regulations applicable to exchanges and theatres. The Chicago code likewise will have to be altered to permit use of double reels.

Noticeably lacking from the parade of film companies which have approved the 2,000-foot standard, in addition to Universal, are the so-called independents, such as Republic, which announced that reel length will be a matter strictly for local exchange preference because of the large expenditure necessary to alter racks and to obtain new reels and shipping cases. Other independents are similarly disposed to let their exchanges decide the issue.

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To the Projectionist

by ADOLPH ZUKOR

¶ There comes in the career of every motion picture that final occasion when all the artistry, all the earnest constructive endeavor of all the man-power and genius of the industry, and all the capital investment, too, must pour through the narrow gate of the projector on its way to the fulfillment of its purpose, the final delivery to the public.

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¶ The projector lens is the neck of the bottle through which all must pass. The projectionist presiding over that mechanism is responsible for the ultimate performance upon which we must all depend.

¶ The projector must not fail and, more importantly still, the man must not fail or permit it to waver in its performance. It is to the tremendous credit of the skill of the modern projectionist that perfect presentation of the motion picture upon the screen is today a commonplace, a perfection that is taken as a matter of course.

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PERIODICAL DIVISION

I. A. Regains Rights, Forces 'Closed Shop' in Studios

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STEP-BY-STEP ANALYSIS OF SOUND REPRODUCING SYSTEMS —LONG REEL SET; I.A. STRONGLY OPPOSED — NOVEL REFLECTOR PROTECTOR—L.U. 327 SERVICING PROGRAM — ROTARY STABILIZER —NEW EQUIPMENT—RECTIFIER DATA—NEWS—CRAFT ITEMS

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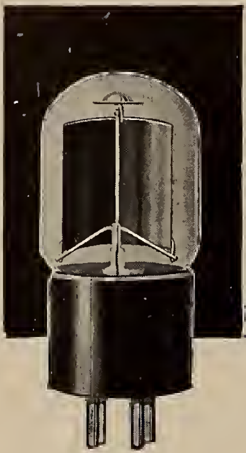

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Edited by James J. Finn

Volume 9 DECEMBER 1935 *Number 6*

Index and Monthly Chat 5

I. A. Regains Rights, Forces 'Closed Shop' in West Coast Studios 7
JAMES J. FINN

Step-by-Step Analysis of Sound Reproducing Systems, XVII . 12
AARON NADELL

I. P. Opposes Policy of Secrecy on Equipment Operating Data 16
EDWARD M. CROCKER

Inventive Trends in the Motion Picture Industry 17
H. D. WALEY

Theoretical and Practical Aspects of the Copper-Oxide Rectifier 18
J. K. ELDERKIN

The Editorial Page 21

Smashing Service Victory Won by Cincinnati Local 22
JACK P. HAWTHORNE

Final Specs. on Proposed Double Reel Submitted by Academy 23

I. A. Officially Disapproves Double Reel; Suggests 'Protest, Pressure' Against It ... 24

Novel Guard Minimizes Mirror Pitting and Breakage 25
E. H. WITT

Glass Port Light Loss 26

Erpi Reported Ready to Adopt RCA Rotary Stabilizer 27

Projections 28
FRANK DUDIAK

News Notes

Technical Hints

Miscellaneous Items

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420

MONTHLY CHAT

THE year just closed was marked by notable advances in the art of projection. Incidentally, the craft did right well by both their work and themselves—an altogether happy state of affairs. We have never lost sight of the fact that decent wages and good working conditions are invariably reflected in a sharp upping of standards.

RECAPITULATING briefly: The craft as a whole averaged a 7% wage rise, without sacrificing working conditions. The road show business stirred—feebly, it is true, but stirred nevertheless. The craft dented, at least, the ring of steel thrown about servicing work by the electrics; and progress in this direction will be much more rapid during 1936. The I. A. regained its studio posts, with the menace of the I.B.E.W. in the amusement field apparently having been obliterated.

REVISIONS of servicing contracts between the electrics and theatres were numerous, thus freeing funds for expenditure on necessary visual projection equipment. Several thousand theatres installed new equipment permitting reproduction of a vastly increased frequency range. Recordings, as such, improved noticeably; although sloppy rerecording work spoiled a few pictures.

SCREENS and lenses remain the same as a year ago. The optical people prophesy important developments on lenses and condensers during 1936. We believe them this time. The Suprex arc developed apace during the year, apart from the fact that mirror pitting remains a prime projection problem. The art continued to tolerate the palpable deficiencies of glass reflectors, partly because of long habit and partly because no really first-class metal substitute came along. Lamp manufacturers sold tons of lamps and didn't make a dime thereby, the result of stupid price wars.

THREE-DIMENSIONAL films still are only a dream, and television is still just around that famous corner that has lengthened out to hundreds of miles. 1936 will be something of a Roman holiday for the television promoters, Barnum's theory still being sound. The NRA, with its cuckoo arbitration provisions, passed away, thank the Lord. Double reels, in use for many years, were given official blessing. Colored motion pictures, favorite in the future book a year ago, did a Brodie and showed nothing at the box office to justify its terrifically high cost.

MORE good pictures and more bad ones were made, which will always be the best indication of motion picture industry health. The box-office continued to be the champion in all divisions.

Happy New Year!

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VOLUME IX NUMBER 6

DECEMBER 1935

I. A. Regains Rights, Forces 'Closed Shop' in West Coast Studios

By JAMES J. FINN

THE International Alliance has regained more than it lost during the disastrous strike of 1933 through a smashing offensive that culminated in a meeting with industry leaders in New York at which recognition of the I. A.'s right to this work was given. In addition, as a direct result of I. A. moves, the West Coast motion picture studios are now 100% organized by A. F. of L. groups under an ironclad "closed shop" agreement already signed (a condition never existant in the studios) and it is an open secret that the I. A. now dominates the studio labor groups.

How all this was accomplished, virtually without advance warning, makes for one of the most thrilling stories, from the viewpoint of I. A. members, that has ever broken in the motion picture industry, and constitutes one of the most glowing chapters in the record of the American labor movement.

Moving with dramatic suddenness and an intensity of purpose that was not to be denied, I. A. officials, headed by President George E. Browne, swept all before them and in one fell swoop catapulted the I. A. into absolute and unchallenged control of labor in the amusement field and gained for the I. A. sufficient prestige to stamp it as the most wide-awake and progressive unit in the Federation.

What the I. A. Gained

The result of this series of bold moves may be summarized in the appended list of studio labor classifications over which the I. A. now has complete control:

1. Projection, of whatever type and character.
2. The setting, striking and operation of lamps, switchboards and all effects, whether in the studio or on location.
3. Property men of all classifications, without exception.
4. Cameramen—including assistants, loaders, etc.—all of whom must hold I. A. cards. The only exception here applies to executive cameramen, of whom there are only a few, who direct camera work but do not actually handle a camera.
5. Laboratory men and similar workers.

To which list must be added under the general heading of Property Men, two classes over which the I. A. heretofore has exercised no control—upholsterers and wardrobe people.

Briefly stated, in the future the I. B. E. W. can only run the power lines up to the studio entrance block and there drop them, everything beyond this point being under I. A. jurisdiction.

This summary reflects the visible, tangible benefits accruing to the I. A. as a result of the settlement. Still unconsidered is the tremendous prestige gained by the I. A., so sweeping was the victory, which inevitably must strengthen

the organization right down the line and particularly in the theatre field, which, since 1933, has been forced to stand strictly on its own. Reasserted is the great power of I. A. participation in the studios, the practical worth of which is known to all I. A. members and thus need not be dwelt upon herein.

This is what the I. A. gained. What did it give in return? Precious little, according to impartial trade observers. Having displaced I. B. E. W. men in all theatres throughout the country prior to the settlement, the I. A. graciously permitted the return of these men to their posts. Thus, the I. A., in effect, swapped some 4800 studio jobs for not more than 70 theatre maintenance posts which the I. B. E. W. held in various cities, such as Chicago, Minneapolis and through Illinois. Placement of I. B. E. W. men in any new theatres, however, is subject to the approval of President Browne.

The one major issue as yet unsettled relates to sound men, whose organization membership status will be determined within sixty days by an arbitrator to be mutually agreed upon by I. A. President Browne and President Dan Tracy of the I. B. E. W. No official expression of opinion as to the outcome of this proceeding was forthcoming from either organization, although it is known that the I. A. is optimistic about the result.

The Basic Studio Agreement, a master contract under which all studio crafts operate, has been reopened for the I. A., which is now a party thereto until 1941, when a new pact will be drafted. Wage scale and working conditions revisions of the Agreement, however, will be considered sometime in February, 1936. I. A. control of the aforementioned classifications of labor will become effective immediately (Jan. 1) notice to this effect already having been posted on studio bulletin boards.

The New Order of Things

First announcement of the settlement precipitated a furor in Hollywood, due to not only what was done but also to the manner of its doing. Visibly affected by the settlement, in addition to those die-hard producers who had felt quite comfortable and secure with the I. E. B. W., were the "deserters" from I. A. ranks during and since the strike and the American Society of Cinematographers, so-called, considered by many as a "company union" masquerading as a "technical" society. The producers had granted exclusive screen credit to members of the A. S. C., and there was much glib talk about the latter having long-term "contracts" for manpower.

The future of the A. S. C. is uncertain at this writing, although West Coast reports the following settlement credited certain producers with attempts to obtain the approval of cameramen for the A. S. C. to represent them in collective bargaining under the provisions of the Wagner Labor Bill. Despite this flurry, it is generally conceded that the A. S. C. in future will exert practically no influence over the wage scale and working conditions of cameramen. That it will be disbanded is seriously doubted; and President Browne of the I. A. is unofficially represented as being unconcerned whether the A. S. C. continues or not, his stand being comparable with his attitude toward any fraternal group. Should the A. S. C. seek to assert itself aggressively, however, there is no doubt that Browne would take prompt vigorous action to have its status defined once and for all.

Late news dispatches from the West Coast forecast the early demise of the A. S. C., as witness the following excerpt from a *Motion Picture Daily* story:

> "A. S. C. executives formally announced the voiding of the five-year pact with studios at two meetings here Friday night, one of first cameramen, the other of second cameramen and still-men."

So much for the widely advertised "contracts" and "pacts" of the A. S. C. This docile and quiescent action is irreconcilable with the normal attitude of an independent labor group.

It is fairly certain that a large majority of I. A. men who, for one reason or another were forced to drop their I. A. membership or to join other organizations, will be reinstated in the I. A. under the new order of things. A positive assertion on this point will have to await the outcome of negotiations now in progress on the Coast.

Of equal interest is the story of events leading up to the settlement. It is common knowledge, of course, that the I. B. E. W. has long cast envious eyes on the I. A. jurisdictional rights in the picture industry, with the 1933 I. A. strike providing the first opportunity to effect an entry into the studios. That the I. B. E. W. considered the studios as merely a base for the extension of their picture industry operations has never been doubted in well-informed quarters.

Typical of I. B. E. W. activities generally was the situation existing in New York City. There the I. B. E. W. not only renewed more than 500 projectionist licenses annually, despite a tilt in fees and without their men working at the craft, but also actually conducted a "sound projection school" which was sold to the organization as "insurance for the future." Periodically the national I. B. E. W. *Journal* contained pointed articles directed at the I. A.

Probably the peak of I. B. E. W. effrontery was reached not long ago when I. A. Local 306 was having difficulties with theatre owners. Reliable sources credit the I. B. E. W. with having made a direct offer to the major theatre circuits to supply 3000 "projectionists" on "short notice." I. A. appeals to the A. F. of L. and to various government agencies during the past several years proved futile.

I. B. E. W.—Producer Alliance

Coincident with a stiffening of the I. B. E. W. attitude there were evident numerous signs of a definite tie-up between that organization and the employing interests. I. B. E. W. entry into studio posts could not possibly have been effected without the active aid of the producers. There could be only one result of this mesalliance—the destruction of the I. A. Bereft of support within the A. F. of L.—wherein the I. B. E. W., with more than 400,000 members and a representative on the Executive Council, wielded great influence—and obviously at odds with the producers, the I. A. seemed to have a hopeless case. Meanwhile, however, I. A. leaders directed by President Browne bided their time and strengthened their lines, awaiting a propitious moment to strike.

This moment arrived with an impact the reverberations of which still are heard through the picture industry. Paramount Pictures Corp., possessed of an incredible ineptness, suddenly demanded the resignation from the I. A. of two members of a camera crew about to leave Los Angeles for the East to take shots for the picture "Thirteen Hours by Air." I. A. membership sufficed to disqualify

Among Those Present—

Present at the top-flight executives' meeting which settled the studio labor question were:

For the I. A.:

President George E. Browne, First Vice-President John P. Nick, Third Vice-President Harland Holmden, Assistant President Louis Krouse, and Steve Newman, West Coast Representative.

For the I. B. E. W.:

President Dan Tracy and others.

For the Carpenters:

President Hutchinson and others.

For the A. F. of M.:

President Joseph Weber and others.

For the Producers:

John E. Otterson, Y. Frank Freeman and Barney Balaban, for Paramount; Herbert Bayard Swope and Leo Spitz, for RKO and Radio Pictures; Harry M. Warner, for Warner Brothers; Jack Cohen, Columbia; R. H. Cochrane, Universal; Sidney R. Kent, 20th Century-Fox; Nicholas Schenck, Metro-Goldwyn-Mayer and Loew's Theatres; and Pat Casey, producer labor representative.

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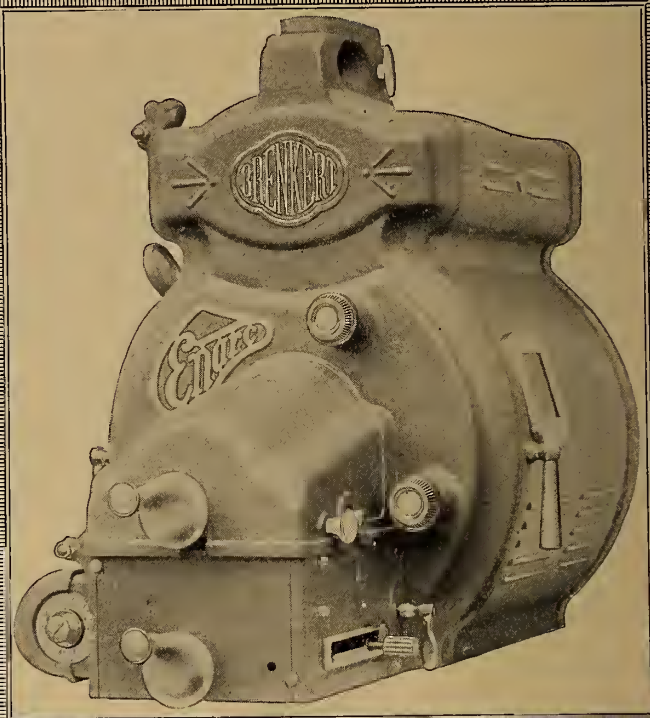

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the men for the jobs, decreed Paramount, which at the same time insisted that the men take out permits with the I. B. E. W. —the farthest point north to which the latter group had ever pushed.

Sad to relate, the two I. A. members acquiesced to the Paramount demands, thus inaugurating a set-up in which the I. B. E. W. sought to conrol camera work, a classification remote from electrical work! Some there are who assert that the I. A. deliberately precipitated this overt act on the part of Paramount as part of a campaign to force a showdown. Whatever the truth or lack of it of this report, the I. A. lost no time in swinging into action following news of the Paramount edict.

Prompt Action by I. A.

President Browne immediately wired all locals to be prepared to pull their members from all houses owned or controlled by Paramount, numbering 288, some 600-odd other theatres being a partnership affair with Paramount. The General Office requested information as to the number of Paramount houses in each Local's territory. Next was issued the order which removed from theatres throughout the country all I. B. E. W. maintenance men, some of whom had held these posts for 25 years or more. This was accomplished without the loss of a single theatre and, in fact, without any untoward incident.

This being done, the I. A. delivered a crushing blow by withdrawing its members from all Paramount houses throughout Illinois. Coming on a Saturday night. this move demoralized the employing interests. As it happened, President John E. Otterson of Paramount, happened to be in Chicago attending a convention.

A conference with I. A. President Browne was hurriedly arranged. the outcome of which was that the Paramount houses were to reopen, after being closed several hours, with the understanding that all industry leaders would meet with Browne within a week to settle definitely the studio situation. Thus far the I. A. had boldly bearded both lions in their own dens.

The ensuing week was a tense period in which many wild reports of a nationwide strike and the like were circulated. The entire industry, and particularly the theatre field. was on edge. bracing itself for what developments it knew not. The I. A. side sawed wood, although the leaders knew that the forthcoming conference held equal possibilities of great success or dismal failure. Subsequent events proved that President Browne elected to shoot the works, disdaining any compromise. The future of the I. A. hung in the balance.

The week passed and the confreres gathered. some coming from the far corners of the country. Only two meetings, occupying a Saturday and a Sunday, were held, the first being of a preliminary nature, all interests not being represented. The second, and final, meeting on Sunday was, as expressed in the popular idiom, the pay-off.

This meeting witnessed the gathering of more industry leaders than had ever before assembled at one time, as is indicated by the published list of those present accompanying this article. Stooges had been ruled out in advance at Browne's insistence, with only top-flight executives being admitted. On Labor's side there were present, as it happened, five members of the A. F. of L. Executive Council. in addition to I. A. representatives. Assets of many millions were represented by the employers present.

The meeting opened at 11 a. m., its import and the tenseness that prevailed being attested to by the fact that nobody left until adjournment at 7:30 p. m. In this comparatively short span of time was decided the future of the I. A. Conflicting stories as to what actually happened at the meeting abound; none of those present has even hinted at procedure. From usually reliable sources, however, this writer gathered that things proceeded somewhat as follows:

Jurisdiction Angle Advanced

Opening the meeting, the producers reverted to the time-worn tactics of passing the buck, informing President Browne that they considered the existing difficulties to be the outcome of a jurisdictional dispute between I. A. and other labor organizations; further, that the producers stood ready to accept whatever settlement could be arrived at between the various labor units concerned.

Next came a speech by an I. B. E. W. representative which, it is understood, recited the glories of his organization and stressed the latitude of I. B. E. W. jurisdictional "rights." Obviously the meeting was veering around to a tussle between labor units, which probably was exactly what the producers had hoped for. This monologue was suddenly interrupted by President Browne, who, it is understood, asserted that he had no acute need for further schooling in jurisdictional "rights" in general and the glories of the electrical workers in particular, his only concern being I. A. rights.

Browne then detailed his conception of I. A. rights, it is said, and wound up with the flat statement that either I. A. would go back into the studios on at least equal rights with other crafts or he would feel impelled to amplify his action of the previous week when he "struck" the Paramount theatres.

The producers are understood to have reentered the discussion at this point by suggesting various attractive compromise solutions; all of which were flatly rejected by Browne, who seemed to be obsessed by the thought that it would have to be a full restoration of I. A. studio rights under the Basic Agreement "or else," the meaning of which phrase was hardly a secret to those present. Browne is credited with the open admission that if the I. A. meant nothing and was so weak and impotent as to be unable to marshall sufficient strength to enforce that which he considered to be its rights, he was content that it should suffer the fate of the weak—extermination. His view that the I. A. was strong enough to enforce its demands, he added, was something that the producers were welcome to put to the test whenever they should elect to do so.

And so the meeting continued. There is no doubt that the conference was productive of a goodly number of dramatic situations, moments so tense that disruption appeared imminent; in fact, Browne is reported to have withdrawn at one stage of the meeting, when he became convinced that the producers and other labor representatives felt that he was bluffing. Truly, here was a battle of wits, a test of courage on the grand scale.

I. A. Wins 'Hands Down'

Finally, a settlement was reached, of a character previously noted. As *Variety* so aptly expressed it, the "I. A. won hands down and left the meeting with everything but the office furniture." The return to work of the 70 I. B. E. W. theatre maintenance men who had been summarily displaced by I. A. men was regarded generally as only a sop to the wounded feelings of the former organization. Even here, however, the I. A. erected a barrier against future encroachments and served plain notice to all concerned that it regarded the amusement field as its own private domain. by reserving the right to approve future assignments of I. B. E. W. men to theatres.

Thus the story of the smashing victory won by the I. A., the full picture of which, according to industry trade papers, is not yet drawn, so confident are observers, particularly on the producer-exhibitor side, that events to date merely presage further gains by the I. A. until a point marking complete control of picture industry labor is attained. The industry generally looks forward, not without apprehension, to the not too distant future when. it is expected, every worker in the theatre field will be enrolled under the I. A. banner.

Whatever the accuracy of these forecasts, existing conditions attest to the magnificent victory scored by the I. A., to its remarkable recuperative powers, to its innate ability to mold victory out of seemingly hopeless defeat, to its apparently inexhaustible store of competent manpower—all of which have combined to restore the I. A. to its former preeminent position in the amusement world.

Step-By-Step Analysis of Sound Reproducing Equipment

By AARON NADELL

XVII

Western Electric TA-4033 Power Unit
Western Electric TA-4037 Filter

THE sound power supply rectifier, or power unit, diagrammed in Fig. 1 is used occasionally in portable sound equipment that accompanies traveling shows, as well as in many theatres as part of a permanent sound installation, consequently the diagram is somewhat complicated by the presence of special provisions used only in connection with field shows but left idle (in fact, inaccessible) in theatre projection rooms.

The a. c. input to this rectifier, in theatre installations, is brought through conduit which fastens to a knockout at the left side of rectifier cabinet (left, facing that cabinet) in the usual way. A. c. wires drawn through that conduit are tied in the usual way to a pair of binding posts located behind the rectifier tubes. That input is not diagrammed in Fig. 1.

The upper left-hand corner of Fig. 1 shows a pair of receptacles into which a pair of 110-volt a. c. cables are plugged when the identical apparatus is used in portable work. The contacts of those two receptacles are wired in parallel, as the drawing shows. The cable entering either one of them will come from the a. c. source. The cable plugged into the other receptacle then goes on to additional apparatus that also requires a. c.

The two-pole, single-throw switch shown just below the receptacles provides separate control of the power to this rectifier when cables are used in portable work. In a theatre installation the receptacles are inactive, and the switch, the points of which are wired to the receptacles, performs no function and can be left in either position. Control of a. c. supply to this rectifier, in a theatre job, is effected through a standard switch mounted, externally to Fig. 1, in series with the a. c. line.

In a theatre installation the a. c. supply is brought to a pair of terminals not shown in the drawing, which are connected in parallel to the blades of the switch just mentioned. The left-hand wire from that switch, to which one of those input terminals is connected, may be traced down and right to the voltage-compensating taps of the power transformer primary. That wire can be attached to any of the six taps, according to the average line voltage encountered at the place of use. In the actual equipment these taps are arranged on a terminal board located behind the rectifier tubes. The same board also carries the two binding posts to which a. c. lines are connected in theatre installations of this apparatus.

The right-hand blade of the switch, the other side of the a. c. input, goes to the top of the power transformer primary.

Three secondaries are wound on this transformer core. The top and bottom secondaries light the filaments of the two rectifying tubes. These filament circuits are readily traced. Starting from the bottom terminal of the uppermost secondary, follow right, down and left to the filament of the upper rectifying tube, V-1; through that filament and right to the first junction, then up and left to the top of the same secondary. Starting at the upper end of the lower secondary, trace right, up and left to the filament of the lower rectifying tube, V-2; through that filament and right to the first junction, thence down through the wire leading straight downward and left to the bottom of the source winding.

Rectifier Plate Circuit

The long middle secondary, center-tapped as in all conventional full-wave rectifiers, provides plate power to the tubes; and current flows, as in all such rectifiers, through the two tubes alternately, according to which plate is positive at the moment. Considering V-1, the upper tube, during any moment when its plate is positive, the circuit of the d. c. output of this rectifier may be traced as follows:

From the filament of V-1 by emission of electrons to the plate of that tube, thence through Fuse F-1 to the top of the transformer plate secondary. Through that secondary to the center-tap, and right from the center-tap to the first point of junction. Here the line branches into three parallel paths. For the present we shall follow only one of those paths, namely, the one that leads straight right and out to the external load through the terminal marked "Exciter Lamp —." Around the external circuit and in again at the binding post in the upper right-hand corner of the drawing, marked "Exciter Lamp +." Thence left through R-3, L-2 and L-1, and so back to the filament of V-1.

At any moment when the plate of V-1 is negative, the space of that tube constitutes an open switch, since emitted electrons are repelled by the plate and no longer connect it with the filament. During such times the plate of V-2, which is connected through Fuse F-2 to the lower end of the power transformer plate secondary, must of course be positive; and the circuit just traced is completed through that tube instead of through V-1. The circuit then runs, beginning at the filament of V-2: through the tube to the plate of V-2; through Fuse F-2 to the lower end of the plate secondary; up to the center-tap of that secondary, and right as before to the point of junction. Continuing straight right from that point, we follow the path previously traced to the external exciter lamp; back in at the top right binding post of the drawing and left through R-3, L-2 and L-1 to the point of junction just left of L-1. Thence straight down to the point of junction just left of L-3, and left to the filament of V-2.

As in any full-wave rectifier, there must be moments when both plates are at zero potential, moments which recur each time the plate secondary of the transformer reverses its polarity, or (with 60-cycle a. c.) 120 times per second. During those moments no current flows across either tube, and at such times current through the output terminals at the right of the diagram would

drop to zero if filters were not included in this rectifier.

Six d. c. output terminals are shown at the right of the drawing, indicating that there must be three d. c. output circuits. Those circuits are connected in parallel to a common source. One has already been traced in part, sufficiently to determine that with an output load connected there is a complete return path for the current through the rectifying tubes. That circuit included the filter choke coils, Reactances L-1 and L-2. Of the two other output circuits of this drawing, one also is filtered and one is not filtered in this rectifier, although an external filter (Fig. 2) is often added to it.

In order to simplify the tracing of these circuits and their rectifiers, the two tubes may be taken as a d. c. source. Referring for a moment to the center-tap of the plate secondary, trace directly right to the first junction point, which may be considered the negative terminal of the d. c. source provided by this rectifier. Referring to the lower leg of the filament of V-1, trace right a fraction of an inch to the first junction point, which point may be considered the d. c. positive terminal.

Exciter Lamp Filter Circuit

From the positive terminal just mentioned, trace to the right through Reactance L-1. Immediately to the right of that coil a condenser, C-1, bridges across to the negative side of the line. Continuing in the same direction, trace through L-2, at the right of which another condenser bridges across the line. Those two coils, and two condensers, are the filter of the exciter circuit.

At any moment when one of the two tube plates is becoming positive, and an increasing voltage is developing across the d. c. source terminals, an increasing magnetic field builds up around the two reactances. In consequence, a counter-electromotive force, or reverse voltage, is generated in the wires of those coils which limits the flow of current to the exciter lamp. A moment later, when the voltage across the source terminals has passed its peak and is diminishing, those magnetic fields decline in strength, and in so doing generate a reinforcing voltage in the windings and increase the flow of current to the exciter lamp.

When the potential difference across the two d. c. source terminals is increasing, Condensers C-1 and C-2 absorb an ever-increasing charge, partially short-circuiting the exciter lamp and depriving it of current. When the source voltage has passed its peak and declines, these condensers can no longer retain the charge that was forced into their plates, but themselves act as d. c. sources reinforcing the flow of exciter lamp current. Condensers and choke-coils act in unison. The exciter lamp current remains steady enough at all times to prevent any trace of hum in the sound.

The fact that *plus* and *minus* signs are shown in the drawing at each side of the condensers indicates that these are electrolytic condensers, which must be connected in circuit in the correct polarity or they will break down at once.

To the right of the condensers a 24-volt signal lamp bridges the exciter line. In the actual apparatus, this lamp is mounted on the right-hand side of the rectifier cabinet. This lamp indicates both that the rectifier is functioning and, by its brightness, that both tubes are functioning and that their space current is normal. A decline in the brightness of this lamp normally indicates that one of the rectifying tubes is no longer operating, or no longer passing sufficient space current. The two tubes are then replaced, one at a time. Return of the signal lamp to full brightness indicates which of the two was defective. If the lamp remains dim after both tubes have been changed, inspect fuses F-1 and F-2, or look for other trouble.

R-1 bleeder resistor is shown in Fig. 1 to the right of the indicating lamp. This resistor serves the double function of lowering the voltage to the output load, and of protecting both Fig. 1 and the other circuits supplied by it in case the exciter lamp burns out or the external circuit is otherwise opened. Rheostat R-3, which follows to the right of R-1, controls the voltage delivered to the exciter lamp.

PEC Amplifier Supply Circuit

Returning to the point chosen to represent the positive terminal of the d. c. source provided by Fig. 1, just right of V-1 filament, trace down to the second point of junction; then to the right through L-3, through L-4, still right through R-4, and out at the terminal marked "P.E.C. Amp. +." Through the external load and back in at the negative terminal of the same circuit, about an inch below, then left as far as possible and up to the three-way junction representing the negative side of the source.

This line is bridged by filter condenser C-3, shown to the right and below filter reactance L-3, and by filter condenser C-4, right and below filter reactance L-4. There is no indicating lamp in this line and, of course, no need for one, since it is a circuit parallel to the output line already traced. Some distance to the right of C-4 the circuit now under consideration is bridged by bleeder resistance R-2; and to the right of that again is series rheostat R-4, which controls the voltage to the P.E.C. amplifier.

Both R-4 and R-3 (the corresponding

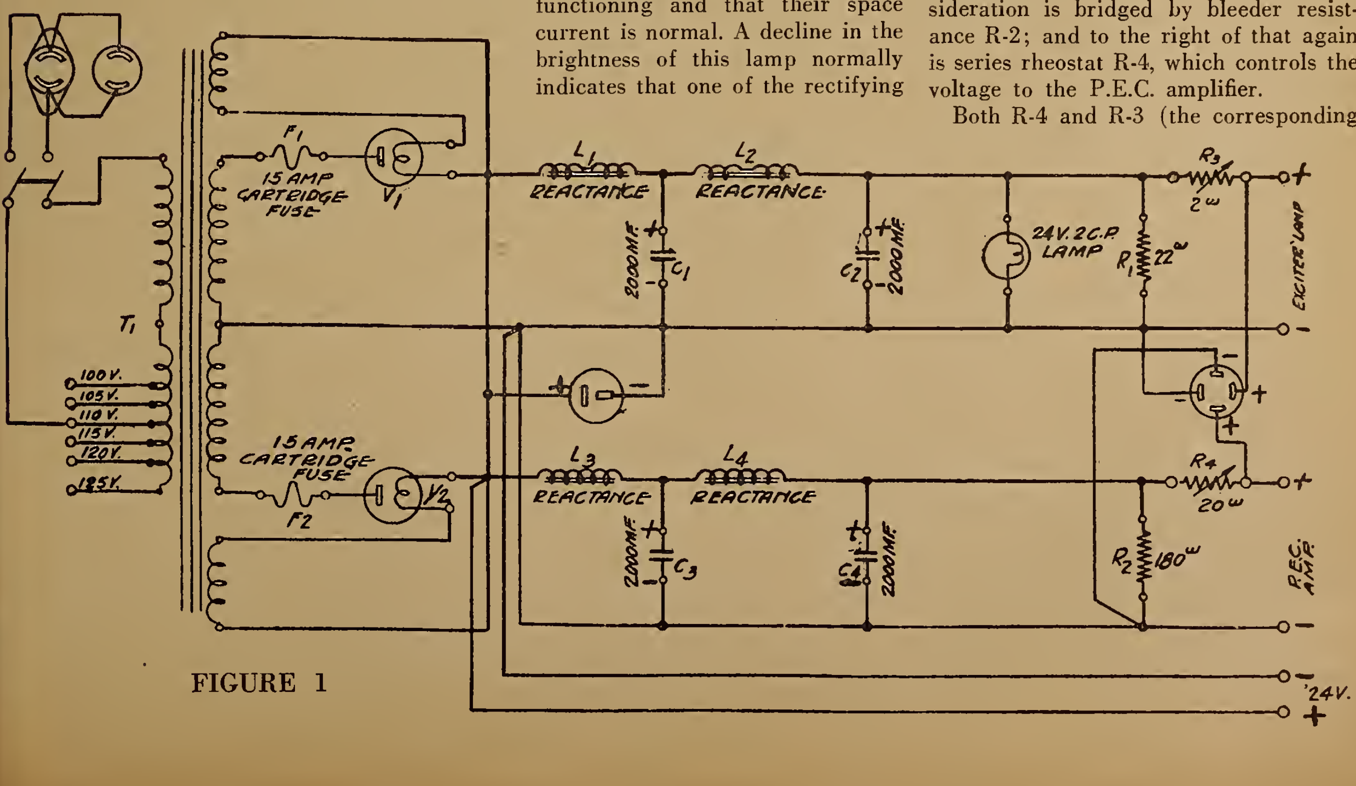

FIGURE 1

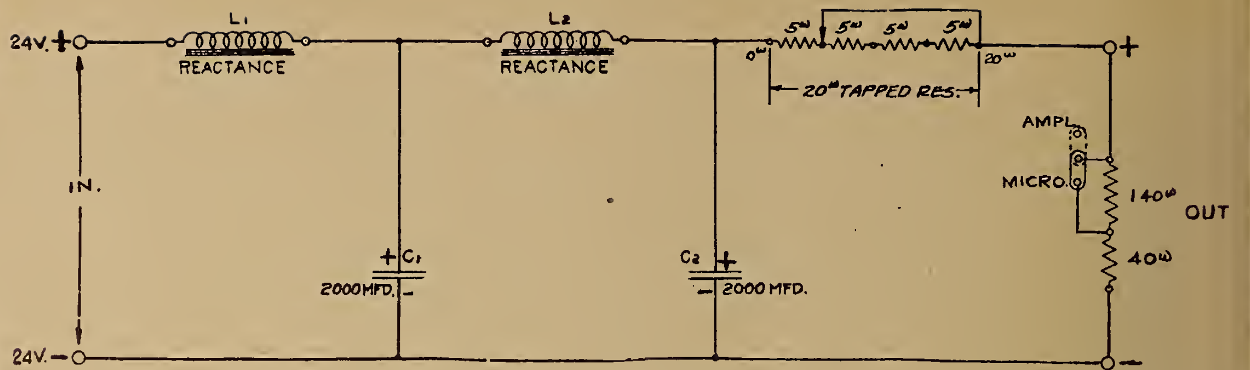

FIGURE 2

rheostat in the exciter lamp circuit) are located on the right side of the cabinet, just below the signal lamp. The double-pole, single-throw a. c. input switch already examined, located in the drawing at the extreme left, is in physical fact the toggle switch just above the indicating lamp on the right-hand side of the cabinet.

The third d. c. circuit of Fig. 1 may be traced from the positive d. c. terminal, at the right of V-1 filament, as follows: Straight down to the second point of junction. Thence, for a trifle, down-left at an angle, and then straight down and right to the bottom right-hand binding post of the drawing. Out to the external load, and in at the upper of the two 24-volt terminals; thence left, up, and up-right at an angle to the negative d. c. source.

External Filter of Fig. 2

This third output, if equipped with external filters, may serve two or even three purposes. It lights the filaments of the small tubes in a W.E. 41 or 46 amplifier. In addition, it excites the fields of as many as three W.E. loud speaker units. In theatres equipped with an announcing system it may also supply operating current to a W.E. carbon microphone.

When unfiltered d.c. drawn from Fig. 1 is used to light the filaments of the 64-type tubes in a system amplifier, the two output terminals shown in the lower right hand corner of Fig. 1 are wired to the left-hand terminals of Fig. 2, which then provides the 24-volt circuit of the rectifier with filtering arrangements similar to those already traced. L-1 of Fig. 2 is followed by a 2,000-microfarad electrolytic condenser, which bridges the line; then by filter reactance L-2; then by another 2,000-microfarad electrolytic condenser; then by a 2-ohm tapped resistor which performs essentially the same function as rheostats R-3 and R-4 in the exciter lamp and PEC amplifier circuits; then by a bleeder resistor which bridges the output terminals of Fig. 2.

The link switch shown just to the left of the bleeder resistor is added because the filter of Fig. 2 may be used for two different purposes. When it serves as a filter to an amplifier filament supply, the link switch is opened and locked in the position indicated by the dotted link labelled "AMPL." The value of the output resistance is then 180 ohms. When the same filter is used to provide current for a carbon announcing microphone, the link is connected to short-circuit the greater part of the resistor, as it is shown in the drawing, and the output resistance is then 40 ohms.

Plug-In Output Terminals

Two of the filters of Fig. 2 may be connected in parallel to the unfiltered output of Fig. 1, supplying both amplifier filaments and microphone current.

In addition, as stated, the same output terminals of Fig. 1 may be wired to the fields of as many as three W.E. speakers connected in series, for which purpose a complete filter is not needed. In part, this is because any hum or ripple introduced at the speakers is not amplified, but chiefly because the speaker field coils in themselves constitute reactances that filter the current supplied to them. If condensers are added, as is usually done when their excitation is derived from the output of Fig. 1, condensers and speaker field together constitute a "brute force" filter identical in principal with those already traced in these diagrams.

The six d. c. output binding posts shown along the right of Fig. 1 are located in the lower part of the actual cabinet, behind the filter condensers. In theatre installations the output wires run through standard conduit which connects with knockouts in the left side of the rectifier cabinet. The back of the cabinet, however, contains four female receptacles, two of which have already been examined in connection with the a. c. input arrangements. They are intended for use in portable installations, in connection with a. c. input cables. The other two are also for portable work, and receive the plugs of the output cables.

The receptacle for the 24-volt unfiltered output is shown in Fig. 1 just above Reactance L-3. It is wired in parallel to the output binding posts at the extreme bottom right of the drawing. From the positive point of that receptacle trace left, down, down-left at an angle, and down and right to the positive 24-volt terminal. From the negative side of the same receptacle trace to the right, up, left to the three-way junction; thence down-left at an angle, down, and right to the negative 24-volt terminal.

A four-way receptacle located just above R-4 rheostat in Fig. 1, provides parallel outputs to the other four d. c. binding posts. A single four-way receptacle is used here because in portable work a four-conductor cable will be used, carrying current to both the exciter lamp and the P.E.C. From the negative exciter lamp terminal trace left to the first junction, and thence down and right to the left-hand negative pole of this female plug. From the positive pole directly opposite trace straight up to the positive exciter lamp output.

From the positive P.E.C. output trace left, up, left, up to the positive point at the bottom of the receptacle. From the negative point directly above it trace up, left, down, down-left at an angle and right to the negative P.E.C. output.

In permanent theatre installations these receptacles are not used, and, when the unit is mounted against a wall in the standard way, are entirely inaccessible and invisible.

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I. P. Opposes Policy of Secrecy on Equipment Operating Data ★

By EDWARD M. CROCKER

INTERNATIONAL PROJECTIONIST has long subscribed to the theory that manufacturers of equipment intended for use in the theatre field —whether for visual or sound projection —should make available to projectionists all data bearing on the design, construction, installation or operation of a particular unit. The theory had its roots in the fact that the projectionist is the "man behind the gun," so to speak, the fellow out on the firing line and the one who has to shoulder the burden of any complaints that may ensue as a result of inefficient operation.

Manufacturers in other fields early recognized the value of placing at the disposal of their customers every scrap of information that might make for a keener insight into the constructional features, and make for better operation, of their equipments. This policy of full cooperation with the customer has paid heavy dividends in increased goodwill and repeat business to those enlightened manufacturers wise enough to adopt it.

Similarly with the motion picture field —until sound motion pictures were introduced. The writer prefers to believe that the policy of secrecy first adhered to by the so-called electrics was the product of the desire to maintain the astronomical prices charged for sound equipments in 1928-29 through the process of ballyhooing the "delicacy" and "intricacy" of their equipments. Invariably the excuse offered by the sound companies in justification of this policy of deep secrecy was that projectionists likely would "tamper" with the equipments. It must be admitted, of course, that there was some basis for this fear. Many projectionists, not unlike some children when confronted with an alarm clock, felt that once an equipment was installed in the projection room (their own little kingdom), they simply must take it apart and find out "what makes it tick." However, this situation is indicative of 1928 or thereabouts, not of 1935.

I. P. recognized the two-headed character of the problem of how best to tap sources of valuable information without inviting trouble resulting from "tinkering" by projectionists in the field. It realized that hand-in-hand with persuading manufacturers to release valuable data it must inculcate in projectionists a proper respect for the fruits of the engineer's labors. It is no exaggeration to state that this educational job on two fronts has been successful, with gratifying results from the standpoints of both parties concerned.

Today one rarely encounters a manufacturer who, having offered a given item of equipment for use in motion picture theatres, refuses to cooperate with the field (his customers) by making available every bit of information relative thereto. It reflects no discredit on the companies named here to state that both Erpi and RCA (and particularly the former) fought I. P.'s program of full and free release of data with every resource at their command. Gradually these and other companies were brought around to I. P.'s viewpoint; and meanwhile I. P. never stopped hammering away at projectionists to hold up their part of the bargain.

To repeat, the campaign was successful all around. Today there is scarcely a manufacturer of any consequence in this field who will refuse or ignore any reasonable request for essential operating data—such as schematics, wiring hook-ups, characteristics, etc. The few notable exceptions, strangely enough, are firms which have come into the field from allied industries, such as radio.

Disapproved Equipment

REPEATED requests for essential operating data having been ignored, I. P. emphatically disapproves the equipment manufactured by, and suggests that the craft withhold its co-operation from, the following companies:

Cincinnati Time Recorder Co.
(*Sound Reproducing Equipment*)

Operadio Manufacturing Co.
(*Sound Reproducing Equipment*)

I. P. holds that there should be no mystery "surrounding" equipment intended to withstand the rigors of daily projection room operation. I. P. disapproves of such policies and, naturally of the equipment sold thereunder. "Mystery" equipments are unworthy of craft attention and should be kept at the factory for the individual experimentation and amusement of their manufacturers.

Show Business Requisites

There is one peculiarity of show business, by comparison with other industries, that suffices to discredit a policy of secrecy with respect to theatre equipment, and that is that the industry is dependent for its success or failure upon the box office take, which in turn depends upon giving full value to the paying customer for the admission price. Freely translated, this means that both picture and sound must hit the screen *every minute* after the program opens. An interruption in the show does not always mean a refund at the box office; but it *unfailingly* does mean a loss of prestige of such proportions as to render silly any comparison between it and a possible refund of a few dollars at the box office. This fact is an axiom of show business, recognized by every person active in the industry.

Now, a patent medicine house, a baker, a soapmaker or any one of scores of other manufacturers may with propriety refuse to divulge the ingredients of his product. Similarly, a coal mine can endure a strike of a few weeks, or even a few months' duration, secure in the knowledge that when work is resumed double or triple shifts can be used to make up for lost time. But not so in show business, every day, every hour in the progress of which is a brand new deal as far as box office receipts are concerned.

These truths, axiomatic in show business, are recounted herein only for the benefit of those who, knowing of them, may speculate on the reason therefor.

Sometime ago I. P. instituted what it was pleased to caption "A Blacklist" of those firms whose rapt admiration for their own engineering genius, or indulgence in some form of commercial hocus-pocus through the sale of an inferior product, made it "necessary" that all information relating to their equipments be withheld. Possibly the choice of a

caption for this niche was unfortunate; maybe I. P. was unduly impressed with its own importance in the role of industry "policeman," as it has been termed lately, to maintain this department and at the same time hold the favor of those manufacturers whose fortune it was to be included therein. In any event, the department has not flourished; in fact, it has languished from lack of nourishment.

In the place of honor at the top of the list there stood only one name—that of the Cincinnati Time Recorder Co., maker of some sort of theatre sound equipment concerning which it refuses positively and absolutely to supply any data, which, incidentally, had been requested by another harrassed projectionist. So forlorn was this single listing that I. P., out of its vast store of charity and goodwill, decided to await the time when the vineyard should be more productive. That time is now at hand.

Appended hereto is a verbatim reproduction of letters exchanged between the Operadio Manufacturing Co., of St. Charles, Illinois (which also makes some sort of sound equipment) and the editor of I. P. The correspondence is enlightening and self-explanatory:

Editor, International Projectionist

Sir: This will acknowledge receipt of your letter of November 18th addressed to our Mr. Klicpera, relative to our furnishing circuit diagrams to projectionists throughout the country.

We were very glad to receive your letter for two reasons: first, to know that there was sufficient interest among your projectionists for circuit diagrams, to warrant their appealing to you; and second that your publication was taking sufficient interest in the requests and welfare of the projectionists to act as sort of a "policeman" in the industry. We are, however, very sorry to note that you felt that it was necessary to "threaten" us in order to accomplish the purpose of your publication.

We have our problems, Mr. Finn, in running our business and adhering to well-established policies, the same as you do. We endeavor, in every respect, to establish such policies as we feel are the best for the general good, realizing, of course, that sometimes these policies are not at all suitable for one individual.

Circuit Data 'Confidential'

In establishing the policy of refusing to send out "promiscuously" the circuit diagrams of equipment which we have spent considerable time and money in developing, we were prompted by two reasons. First, we felt that the information contained in these circuit diagrams was more or less confidential; although we appreciate at the same time, that if any person who wanted to obtain a circuit of our equipment and had the ability, could do so by merely buying the particular equipment. Second, even though we would be willing to make public property the results of our engineering, we still feel that the promiscuous distribution of circuit diagrams might do more harm than good from a service standpoint, for the reason that it might tempt the person who did not have sufficient ability or knowledge to "tinker" with an amplifier, whereas if he didn't have the circuit diagram he would not be tempted.

Up to the present time, Mr. Finn, we have been under the impression—this may be erroneous—that the average projectionist is not familiar with, nor has any attempt been made to train him into, the intracacies and problems of servicing electrical amplifiers. In the radio industry, generally speaking, there has been no attempt to encroach into the work of servicing and repairing of projectors, the radio man feeling, in the first place, that he knows nothing about projectors and that it is a specialized field; and secondly, that there are authorized men who make their living servicing projectors and that this work should be done by them.

In general, we agree with this policy. In no instance have we nor our distributors intentionally refused our circuit diagrams to authorized radio service men who make it their business to service and repair our amplifiers. Therefore, if the request to which you refer in your letter of November 18th comes from a man who is experienced in the repair of amplifiers and associated equipment, we will be more than happy to see that he receives a circuit diagram covering the equipment of our manufacture which he has.

In closing, we hope you will take the spirit in which this letter is written. I am sure if you and I could sit across the desk from each other, there would be no question as to the spirit of this letter. I hope that sometime I may have the privilege of doing this. We hope that this letter will satisfy your request and will prevent our being placed on your "black list."

OPERADIO MANUFACTURING CO.,
Lawrence B. King, *Sales Manager.*

The editor of I. P. having swallowed copious draughts of similar bromidics in days long since fled the memory of man, there was dispatched to the Operadio

(*Continued on page* 32)

INVENTIVE TRENDS IN THE MOTION PICTURE ART

By H. D. WALEY

INVENTIONS can be sorted out into two sizes—big and small. The big inventions—sound-film and color-film, for example—are created by the incurable inventiveness of inventors and commercialized by the advantage which novelty gives to the showman. The small inventions are those created by the trade technicians in order to overcome the limitations inadvertently imposed on the producer by the big inventions.

It would obviously be possible to make a very long list of the small inventions which were requisite before the limitations imposed by the sound-film were overcome—faster emulsions, wider-aperture lenses, silent-running cameras, higher-powered incandescent lamps, more directional microphones, etc. Without these the sound-film was in danger of being so narrowed in its scope by technical considerations that public interest in it would have withered once its novelty value had worn off. The trade technicians came to the rescue and the film recovered much, at any rate, of its former freedom of movement.

Stereoscopic Picture Requisites

The color-film will also clearly bring in its wake a host of small but highly necessary inventions. Not only will emulsions, lenses, cameras, lighting systems and processing plant be affected, but it is also to be expected that the high cost of each print will affect projector design with a view to minimizing wear in the gate. We may even see a revival of interest in non-intermittent projectors with optical compensation.

Stereoscopy is, of course, the most talked of among the big inventions which are perpetually rumored to be lurking just around the corner, but somehow fail to arrive.

I suspect that rather loose thinking accounts for the idea that there are existing stereoscopic devices which only need working up to theatre pitch. People notice the stereoscopic effect obtained by filming from a moving car; learn that there is no difficulty at all about producing "peep-show" stereoscopic effects for a single viewer; that a whole audience can enjoy a true stereoscopic effect, if it doesn't mind wearing colored spectacles; that Ives and Jellinek continue researching on multiple-image stereoscopy, and that stereoscopic display transparencies have arrived on the market. The impression forms in their minds that all these separate achievements will soon somehow be fused in a single triumphant success.

This is a very misleading impression. Each of these approaches is separate and has its own limitations, and these limitations are not the kind that depend merely on small items of technical progress.

Thus, moving viewpoint stereoscopy, the sort obtained by filming from a car, has no connection with binocular stereoscopy. A one-eyed man sees a more three-dimensional world from a moving car because the apparent speed of displacement of objects in different planes gives him some clue as to their relative position. But, clearly, films which involved perpetual motion on the part of

(*Continued on page* 31)

THEORETICAL AND PRACTICAL ASPECTS OF THE COPPER-OXIDE RECTIFIER

By J. K. ELDERKIN
FOREST MANUFACTURING CORP.

COPPER-OXIDE rectifiers are not new, having been used for many industrial applications for the past ten years. Its application to the motion picture projection field, however, is of comparatively recent origin. Today this type of rectifier, employing copper-oxide rectifying elements instead of bulbs, is used as a source of direct current for supplying Suprex arcs.

Despite the ready acceptance given the copper-oxide rectifier by the field, and the accompanying generous space devoted by technical journals to its construction, operation and characteristics, there apparently remain many features of this unit which projectionists would like to have explained. This article will attempt to satisfy this demand.

Until a few years ago the copper-oxide rectifier was commonly thought to be limited in its industrial application to devices requiring low currents, since currents of the higher order meant that many copper-oxide discs would have to be connected in multiple. This unit was also thought to be limited as to applied potential—that is, each disc was limited to the amount of voltage that could safely be applied to it. This meant, then, that if each disc could safely handle, say, 4 volts, higher voltage requirements would increase the number of series-connected discs. Thus, increased voltage and current meant greatly increasing the number of discs. On this basis, a rectifier suitable for handling a current of the order of 50 amperes and a voltage of about 40 would require a rectifier of such bulk, weight and cost as to render impracticable such a unit, at least for theatre projection work.

The current that a single copper-oxide disc is capable of handling is limited chiefly by temperature. For example: a given size disc without cooling fins might have a capacity of 1/8 amperes; while the same disc with 2¼" fins would have a capacity of ¼ ampere; with 3" fins, ½ ampere, and with 3⅝" fins, ¾ ampere. With the foregoing rating based upon only natural ventilation, it follows that a unit with *forced* ventilation and proper fin construction will be capable of carrying considerably more current.

The number of discs to be used on a particular rectifier, then, is dependent upon the cooling fin area and the effectiveness of the forced cooling means. There are other important considerations of design, of course, but these need not be detailed for the purposes of this article.

Operating Temperature Important

One of the most important points to be considered in the design of this unit is that the discs must be sufficient in number to remain well within the allowable temperature rise after the unit has "aged" and the ultimate temperature which it will have to withstand has been attained. Naturally, more heat will be generated by an "aged" unit than by a new one. Pertinent and eminently correct data on this "aging" process have appeared in these columns from time to time.

Through the use of an efficient forced cooling means it has been possible to utilize the copper-oxide rectifier in those fields which require voltages and amperages of the higher order, thus banishing the notion prevailing previously that the use of this unit is confined to low-current applications.

One of the most important developments of recent years in projection work was the introduction of the Suprex arc, more than 3,000 of which are now in use in the theatre field. This arc requires low voltage as compared with other type arcs, which characteristic favors the copper-oxide rectifier in that the lower the voltage requirement, the fewer number of discs need be connected in series; consequently, the unit need have less bulk and weight, and will cost less than would a rectifier designed for higher voltage requirements.

The copper-oxide rectifier gives rise to numerous questions anent its design and functioning, and projectionists, to their credit, have hit upon more questions to pose than any other group that has used the unit. Appended hereto is a description of this rectifier which should answer those questions most commonly submitted.

The What, Why and How

The basic element of the copper-oxide rectifier is a disc of copper, on one side of which has been formed a layer of red, or cuprous, oxide (Cu_2O) at a temperature slightly under the melting point of the copper. This washer has the characteristic of asymetric resistance, passing current freely in the direction of oxide-to-copper, but with difficulty in the reverse direction. Fig. 1 is a diagram of a single disc showing the direction of current flow.

It should be clearly understood that the rectifying layer lies between the mother copper and the adherent cuprous oxide. This is generally admitted to be true and can be readily proved. For example, practically any metal, even copper, can be used to contact with the outer surface of the oxide without affecting the rectification. Again, any work which is done to improve the contact at the outer surface, such as the graphitizing, changes the resistance in the forward direction but does not affect the back resistance. Furthermore, if the oxide be ground away in thin layers, the forward resistance is gradually reduced, but the back resistance is not affected until the oxide is completely removed, when the back resistance is at once short-circuited.

More than one theory exists as to the mechanism of rectification in the copper-oxide rectifier. Since proper application of units can be made without knowledge as to why the rectifier works

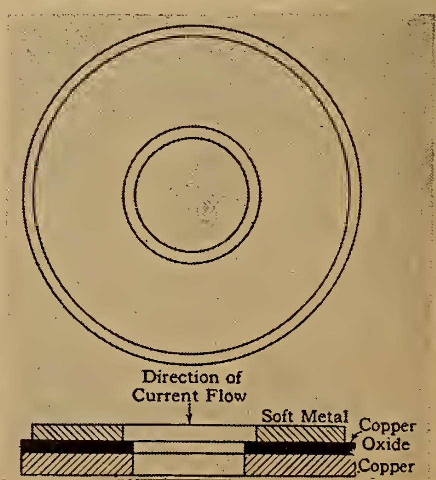

Figure 1

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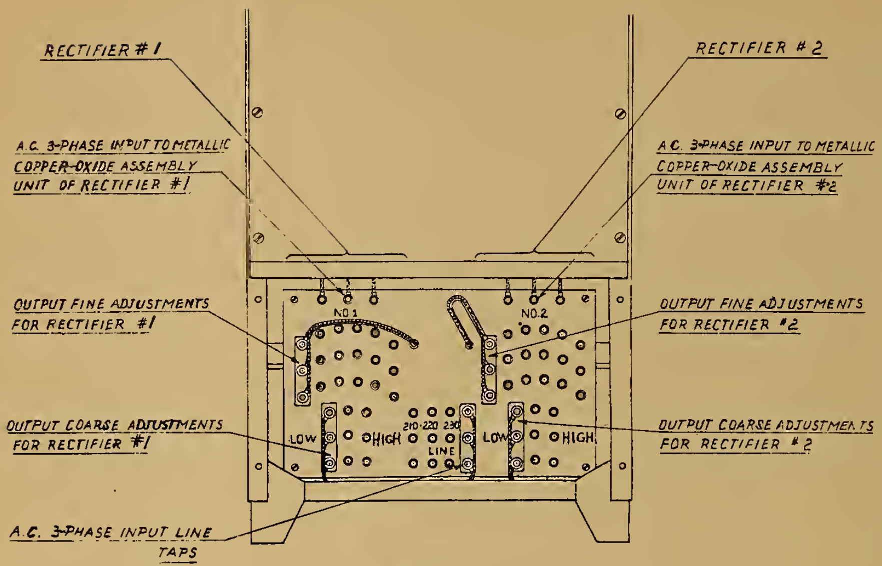


FIGURE 2

This twin-type rectifier is really a double-duty unit, being two separate and complete rectifiers in one housing. The unit has two sets each of transformers, copper-oxide rectifying assemblies, assembly wiring, output control studs, output circuits, etc.

When only one lamp is operating, one rectifying unit is in use, the other being inactive and consuming no current. During change-overs, when both lamps are in use, both rectifiers function. As soon as one lamp is cut off, the associated rectifier also cuts off.

If emergency protection is required, two double-pole, double-throw switches can be added to the installation, so that in an emergency two arcs can be operated from either rectifier in the one housing.

as it does, so long as we know how it works, there is no object in discussing the theory here. It is sufficient to say that as a result of the process of manufacture, a combination of copper and copper-oxide is formed in which it is relatively easy for electrons to escape from the copper to the oxide, but quite difficult for them to leave the oxide and pass into the copper.

Pressure and Contact

Reduction of the forward resistance to a minimum is, of course, a desired objective. Consequently, in assembling discs care is taken to eliminate as far as possible any contact resistance between the surface of the oxide and the adjacent metal part. This is accomplished in two steps. Contact resistance is first reduced by graphitizing the oxide surface. Contact is then made through a soft metal washer which is forced into intimate relation with the oxide by pressure. This washer then accommodates itself to the unevennesses of the oxide surface, insuring the availability of the entire surface for the conduction of current. The soft metal washer plays no part in the rectification, being purely a contact member.

Forward resistance decreases with increase in pressure up to about 3,000 pounds total on a single stack, at which point constancy is reached. This pressure does not have to be maintained, since it can be released after reaching 3,000 pounds and reapplied to 1,000 pounds with about the same results.

The back resistance is practically unchanged until the high value of 6,500 pounds is reached, at which point the oxide is crushed and a large increase takes place in back current for the same voltage.

Suprex Arc Application

In the application of the copper-oxide rectifier to Suprex arc operation a proper number of discs and fins are grouped together in series-multiple arrangement which forms one element of the entire unit. Each one of these elements is in itself a half-wave rectifier; then, by a bridge connection the individual half-wave elements rectify the three-phase alternating current supplied to them into full-wave direct current.

Due to the 120-degree overlapping of all phases of a three-phase current, the d. c. derived from same has the identical characteristic, thereby giving a very smooth output. The reactance of the circuit and transformer, and the resistance characteristics of copper-oxide rectifiers, assist in removing the small amount of ripple that might be present with other types of three-phase rectifiers.

Complete Twin Assembly

The complete rectifier consists of a three-phase transformer having *primary* taps to adapt the unit to the line voltage at the point of installation, and *secondary* taps for adjustment of the output current of the rectifier. These latter taps are in two groups, "coarse" and "fine," so that the output current can be regulated to the exact requirement. The twin units, of course, have exactly the same "coarse" and "fine" adjustment for each of the two output circuits, as is shown in Fig. 2.

Above the transformers are the copper-oxide rectifiers, which are all mounted and connected in a metal tray that is easily removed. In the top of the rectifier and secured thereto is a 16-inch special fan so located above the rectifying units that air is drawn from the bottom, through the cooling fins, and exhausted through the top of the housing. The air flow is perfectly balanced so that each unit is equally cooled.

Protective devices are connected into the fan circuit so that in the event of any interruption of that unit the current to the rectifier is automatically cut off, thus safeguarding the rectifier from any possible danger of overheating.

This type of rectifier is intended for use with Suprex arcs on three-phase supply. If only two-phase supply is available, an external transformer, which by means of a Scott connection changes two-phase to three-phase supply, is used, and the three-phase current is then supplied to the rectifier.

The efficiency and power factor of the copper-oxide rectifier is high, and the unit will give years of satisfactory service without trouble or the need for replacements.

RCA-Erpi Settlement Opens Up Studio, Theatre Fields

Settlement of the RCA-Erpi sound picture war has been reached, according to reliable advices. Details of the pact were not made public, but it is understood that the following figured importantly therein:

1. Erpi ironclad recording and reproducing licenses will be modified to permit unrestricted competition. This is something that RCA has long wanted, particularly in the recording field.
2. Erpi will desist in the future from alleged unfair practices in studio and theatre fields.
3. Money damages to RCA, of an amount unknown.

Recording Royalties the Goal

These provisions, if true, match those points named as the probable basis of settlement reported exclusively by I. P. four months ago. RCA will now be able to go ahead with its invasion of the recording field, with its juicy royalties of about $700 a reel, the alleged theatre field abuses having served admirably as a wedge into this situation.

Incidentally, RCA is understood to have made deep inroads into Erpi theatre field business, a large portion of RCA business today being replacements. RCA long ago adopted a liberal sales policy of outright sale, no compulsory service charges and no restrictions as to replacement parts, a program which has been attended by great success.

The IP EDITORIAL PAGE

Vol. 9, No. 6 DECEMBER 1935

Cincinnati Show 'Em How It is Done

Elsewhere in this issue appears an article by President J. Hawthorne of Local 327, Cincinnati, detailing the preparation for and the introduction and operation of that organization's present very successful sound system servicing plan. The Cincinnati plan is more than an approximation —it is a duplicate—of the procedure outlined on several occasions in these pages. Naturally, I. P. is proud to have been of such service. But vastly more important to I. P., and to the craft in general, is the evidence that a similar course is open to every projectionist organization in America. I. P. is looking forward not to credit but to a growing list of theatres serviced exclusively by projectionists.

When I. P. first proposed that projectionists take over servicing operations there arose a chorus of doubt, sung by the electrics and by the craft itself, the theme of which is best described by the phrase, "it can't be done." The utter nonsense of this viewpoint is demonstrated by the Cincinnati report. After all, figured I. P., if projectionist groups in Cleveland and San Francisco could service sound equipments, there was no reason why others couldn't do the same thing —that is, no reason other than the lack of foresight and initiative. The electrics asserted that the craft in general was incompetent to handle such work; and there was considerable truth in this view. A shortage of necessary replacement parts was also referred to by the electrics. Last but by no means least there was the matter of existing servicing contracts, a consideration of vital importance, if various Locals preferred to stay away from courts and avoid heavy damage suits. I. P. emphasized all these points.

The same difficulties relative to the assumption of servicing work by projectionists exist today. But the view that these hurdles are insurmountable has been effectively riddled by the experience of the Cincinnati organization—if, in fact, it had not been so demonstrated previously by the Cleveland and San Francisco locals. Cincinnati is reported to now have 18 theatres on service, the successful execution of which work should warrant an extension of its service to every theatre in that city. Wise indeed is the determination of Local 327 to adhere to its original no-profit plan.

Reams of copy could be written to emphasize in detail the significance of this magnificent show of progressivism by Local 327. But to what useful end? All necessary information relative to servicing has been on view in these columns for many months past. The I. A. has taken a firm stand in support of projectionist servicing. The experience of several Locals to date proves conclusively that the plan is workable. The electrics' servicing contracts are expiring daily in increasing numbers. Replacement parts offer no serious problem. Exhibitors are tired of paying inflated service charges. Against the absence of profits in such a plan must be weighed the splendid job-insurance inherent in such a service through effecting a closer tie between Union and employer and in barring the way to outside competition.

If any other activity can return such dividends to projectionist organizations, I. P. would like to hear about it. The facts are plain: the only bar to sound system servicing by projectionists on a nation-wide scale is a lack of initiative on the part of projectionist organizations. All other considerations are just so much conversation, an alibi to conceal rather than reveal the truth.

Why Not a Subsidiary Technical Group?

I. P. has fought a valiant, if thus far unsuccessful, fight for the establishment within the national projectionist organization of a bureau that would concern itself exclusively with technical matters. The set-up today admits of concern only for wages and working conditions, quite important in itself, of course, but a function of Union activity which might well benefit through aid from the aforementioned bureau. This suggested department would concern itself with all technical matters bearing on either improved operation or the welfare of the craft. For example: suppose a new arc lamp were introduced. Assume that this lamp were defective in design to the extent that it failed to deliver maximum efficient results, or that its operation constituted a definite hazard to projectionists. Wouldn't a theatre owner welcome an impartial, unbiased report of inefficient operation? Certainly he would. Wouldn't such a service help to cement friendly relations with the exhibitor? Positively. And isn't the craft entitled to advance reports on technical developments which promise to affect either its security or welfare?

The alert reader has divined by this time that we have been edging around to the topic of double reels; the handling of which development by projectionist organizations effectively demolishes any pretense on their part to being a cohesive national unit. I. P. has rendered the craft yeoman service in this matter, over and beyond the usual functions of a publication. Advance warnings on double reels have appeared herein for the past four years. I. P. has written scores of letters in the interim to Local units and to the parent body of projectionists which sought to develop a unified stand on the matter. Opposition to double reels at meetings of technical or engineering societies was impossible on any rational basis in the face of the record showing that 85% of the country was doubling! By contrast with this record of activity by I. P. was the attitude of those who, opposed to the double reel, either sat grimly silent in the childish hope that "something would happen" to stay its advent or indulged in the ludicrous horseplay of passing resolutions which were left to rot in books of proceedings without benefit of any effective means to lend them force.

Meanwhile agents of the Academy were galivanting around the country contacting this, that and the other Local organization, getting the ear of fire authorities and insurance company representatives and winning approval of the long reel on a purely local basis! With all preparations complete, even down to specifications for the long reel, projectionists suddenly came to life and began to "fight" the double reel— not by actually fighting it, you see, but by again passing resolutions which are as devoid of force and authority as is a booking agent of sentiment. The horse has been gone from this barn so long that there isn't even a door left.

The double-reel situation merely emphasizes the point of this editorial. The time has come, as we see it, when some degree of interest in technical matters must be manifested by projectionist organizations. Practically every other craft of which we have any knowledge has adopted such a policy, with great success. Any Labor group which stubbornly refuses to face these facts is a decandent organization.

Symbol of service: L. U. 327 sound truck parked in front of a downtown theatre

Smashing Servicing Victory Won by Cincinnati Projection Local

By JACK P. HAWTHORNE

PRESIDENT, I. A. PROJECTIONIST LOCAL 327, CINCINNATI, OHIO

FROM the first time that I saw an outside service man come into the projection room where I was employed, I inwardly rebelled at conditions which made his presence necessary. I realized that nothing could be done about the situation at that time, but I recall vowing that if the opportunity ever presented itself, I would spare no effort to regain this work for the craft.

When sound pictures were first introduced the projectionist craft had neither the inclination nor the ability to do servicing work. Along with many other projectionists, I realized that absolutely nothing could be accomplished along this line until such time as the craft was able to not only take over this type of work but also do a good job thereon.

Early in 1935 I felt that the hour for action by the craft had struck. A few theatres in our jurisdiction, having sound contracts that expired, dispensed with servicing by the so-called electrics. Thereafter when trouble developed some theatres would call the local radio man to service their equipments. Other theatres called upon the Union to do the work.

It required no great intelligence to perceive that such a condition could not long endure without serious trouble developing as between the Union and the radio men, on the one hand, and between both servicing groups and the theatres, on the other hand. It wouldn't take long, I figured, before the radio men would be slipping the exhibitor a radio or a tube discount, or some other such gratuity, with the result that shortly the radio men would have the sound servicing contract for keeps. The result of such arrangements would be that instead of a couple of electrics' men coming into the projection room, the place would be overrun with every Tom, Dick and Harry.

Along about this time INTERNATIONAL PROJECTIONIST launched its campaign in behalf of sound system servicing by Local Unions. Then there appeared in the I. A. *Official Bulletin* an article by International President George E. Browne with regard to the same proposition. That settled the argument so far as I was concerned.

Calling together the Executive Board of our Local, I explained the proposition as I saw it, being careful to omit nothing that would show up the situation as it was rather than as I might wish it to be. The Local adopted the Board's recommendation that I be allowed to make a survey of what other localities were doing on this question. To my surprise, after visiting a few cities, I found that sound system servicing conditions in Cincinnati were duplicated elsewhere. I reported back to the Local, told them what I had learned, and emphasized the the fact that the job ahead would be a case of pioneering, diplomacy, secrecy and good judgment.

I was then given full authority to unravel the muddled servicing situation. First I reviewed the electrics' methods, being careful to note all the mistakes they had made (which were many), and then I added to the plan those elements of service which I felt the electrics never had given. The electrics' experience, plus our own intimate knowledge of what was and was not necessary, provided the foundation for our Local servicing.

The next step was to feel the pulse of the exhibitor. We found that our progress depended upon two important elements: *Cost* and *Competency*. We offered an exclusive sound service at a flat monthly rate, and invariably the exhibitor popped first the questions relative to cost and competency. After all, it

The Author Says—

The purpose of this article is to advance the cause of sound system servicing by I. A. Local Unions. If anything contained herein will help to extend servicing work by the craft—work which the writer feels is rightfully theirs—then its purpose will have been accomplished and the author will feel more than amply repaid.

was not unexpected that the exhibitor should be sold on the electrics' engineers, despite certain obvious shortcomings of the latter group, which had been ballyhooed into a niche of know-it-all pre-eminence. The exhibitors' only quarrel with the electrics was on the financial angle.

The passage ot time served to heighten my first impression that costs and competency were the all-important obstacles to hurdle. I put the matter up to a group of the best-qualified men in the Local; and I was surprised to learn that even some of our own men would resent the presence in their projection rooms of another Local man, however competent. This may sound strange to the craft at large, yet it must be said herein so that other groups may be aware of and give due consideration to this very important angle.

This development settled for me the question of who should do the work. It would have to be an outsider, one who would be taken in, given a card and placed in full charge of the new department. If additional manpower were required, our own competent fellows could assist under the *supervision* of the chief. We obtained an ex-Erpi man in whom we had great confidence, not only on the score of competency but also with respect to his social outlook—if I make myself clear. Thus, the decks were cleared for the job ahead.

Now, to put even the smallest things over (and this was no small matter to us) there must be honesty of purpose. I had always had this thought in mind, and I pounded the idea home at every chance that presented itself. I stated publicly at various times that the new service department was not a money-making venture by the Local; we would be satisfied to break even all around, or, if necessary, to even absorb a small loss. The new department was advertised as merely an extension of the service we already rendered the theatre field in the way of projection, etc. All parts, labor, materials, etc., were to be billed at cost. The exhibitors took kindly to this plan —justifiably so, as subsequent events proved.

Our fixed service rate was far below that of either of the electrics, and it early became apparent that unless we could quickly gain theatres we would have to dig pretty deeply into our individual pockets in order to make up the deficit. We had agreed to pay our chief engineer a very respectable salary, which had to be paid from the very start, irrespective of how many theatres we had on service. The question of obtaining needed sound parts also bothered us quite a bit. To date, however, we have come through all along the line.

We made good on our promise to the exhibitors to buy a sound truck, thus insuring fast service throughout the city. We bought a new panel truck, painted a bright cream color and with our emblem on each side of the panel, lettering being in gold, black and red (see headpiece of this article). Two sound trumpets are mounted atop the truck. We obtained permission from the Safety Director to park in front of theatres on regular and emergency calls. Sunday we park the truck all day on Main St., resulting in plenty of free advertising for our service.

The truck contains practically every part needed for quick and efficient repair work. If there is a break in the show and we do not have the exact part needed, we can clip onto the a. c. supply with our own sound system, including horns. The electrics could never match this speedy complete service, particularly in cases of serious trouble. Our truck carries a very fine portable amplifier, in addition to an analyzer so modern that it will take care of the recently introduced metal tubes.

We launch our service with sufficient theatres to keep the deficit very small, considering the overall expense involved, which was plenty. We are going along steadily at the moment, and are constantly adding new theatres to our list, which naturally tends to wipe out the deficit. Irrespective of how many theatres we eventually have on our service list, we shall not lose sight of our original no-profit motive.

We think that Local 327 today is rendering Cincinnati exhibitors the finest sound service at the lowest price that they have ever had. Those who doubt this are promptly referred to those exhibitors now taking our service. We never worry about such a reference, because the greatest boosters for our service are the exhibitors now on our list.

What comparison can be drawn between possible profits from such work (after sufficient theatres are taken over) and the tremendous good derived by a Local Union through a service which ties our customers, the exhibitors, so closely to the Union? The answer is: None. Exhibitors now look to our organization as the best group to handle not only their projection but also their service work. If the value of this situation can be measured in dollars and cents, the writer would like to know it.

There were objections to our engaging in service work, of course; but the results obtained in such a comparatively

(Continued on page 30)

Final Specs. on Proposed Double Reel Submitted by Academy

FINAL specifications of the proposed double reel standard, as revised by the Academy in line with the request of various branches of the industry—distributors, projectionists, exhibitors and fire authorities — are appended hereto along with a drawing showing the various dimensions. The new double reel is expected to become standard throughout the industry on April 1 next. The specifications:

The reel shall have an outside diameter of 15 inches, a hub diameter of 5 inches, and an inside clear width of 1½ inches. The center bushing shall be of such size as to provide an easy fit on all standard 5/16 inch diameter rewind and projection machine spindles and shall have a ⅛ by ⅛ inch keyway.

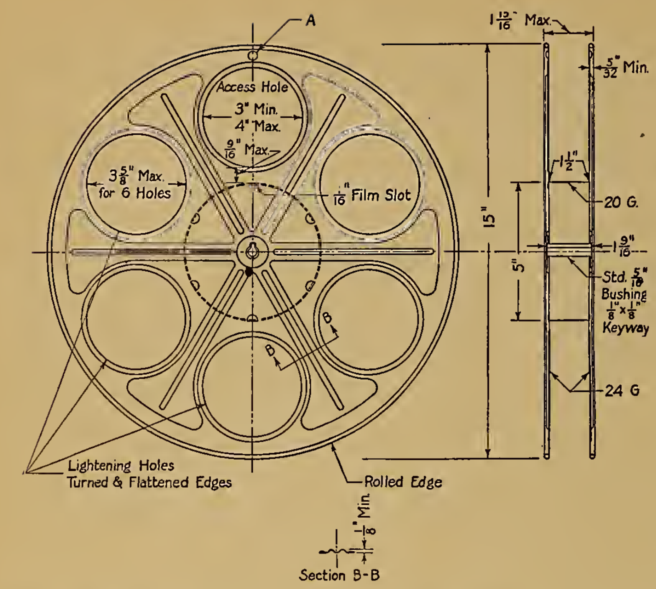
Dimensions of Reel

An access hole for threading shall be provided in each flange adjacent to the film slot, having a minimum diameter of 3 inches, and located as shown on the accompanying drawing. The number, size and position of lightening holes in flanges is not specified other than that they must be of such number and position to provide an acceptable running balance.

The reel shall be constructed of No. 24 USS gage [.025″] (except the hub which shall be constructed of No. 20 USS gage [.0375″]) with rib heights and rolled edges of dimensions as shown on the drawing except that thinner gages and slightly greater rib heights may be used for economy of construction, provided such design makes up into a reel of equivalent stiffness in the flanges to the one of specified dimensions. A thin gage which might permit denting of the ribs during use but which at the same time would maintain the essential working dimensions of the reel would be acceptable.

The reel shall be entirely free from raw edges on all portions which come in contact with film or the hands. The edges of all hand openings shall be turned and flattened, and the outer edge of flanges shall be rolled. Flanges shall have an embossed spot near the periphery, opposite the opening adjacent to the threading slot, as shown at "A" on the drawing.

Reel flanges shall have a sufficient area of flat contact surfaces on the inside to provide ample bearing for the edges of the film. Rib heights shall be slightly less than the height of the pheripheral rolled edge to allow for stacking. All flanges shall be free from warping or buckling after assembly and



Specifications for the Academy proposed 35-mm. standard 2000-foot projection reel, as revised 11/6/35. General introduction of this reel is slated for April 1 next, with reels now in production.

shall run true within 1/32 inch when the reel is spun on a 5/16 inch shaft.

Center bushing shall fit solidly into side flanges without looseness when assembled, and shall be of sufficient strength to withstand the wear and tear of usage. Clinching ears shall fit tightly and shall be pressed down firmly so as to make a solid assembly of the reel and to insure at all times 1/16 inch slot for threading the film end into the hub.

Materials, Tolerances, Cost

Material shall be steel with anti-corrosive plating or coating, or non-corrosive alloy. Finish shall be suitable to protect against the wear of use and against the corrosion of ordinary atmospheric influences.

To allow for the utmost freedom in design of the reel, maximum and minimum dimensions are indicated on the drawing wherever possible but where such values are not shown, the specific dimensions shall be strictly adhered to within the limits of good practice. The total weight of the reel and its cost price must be closely comparable to two first class reels of 1000 feet film capacity. Any cheapness in the reel made possible by weak construction shall be deemed unsatisfactory.

Any concentric grooving in the flanges which will permit layers of film to shift laterally shall be considered unsatisfactory. Enamel or paint finishes are not recommended and unless they offer exceptional resistance to wear and chipping shall be considered unsatisfactory. Any reel on which the plating or dipped finish cracks during forming or assembling shall be considered unsatisfactory.

NOTE: Manufacturers preparing standard reels meeting these specifications should take whatever precautions may be necessary to assure themselves that they are not infringing any existing patents which cover the features suggested in the specifications.

I. A. OFFICALLY DISAPPROVES LONG REEL; SUGGESTS 'PROTEST, PRESSURE' AGAINST IT

DESPITE the unmistakable wide-spread trend toward double reels within the past five years, the first official expression of I. A. opinion on this topic is contained in the current issue of the *Official Bulletin,* a verbatim copy of which follows:

"Falsified reports are being circulated throughout this country and Canada to the effect that the International Alliance interposes no objection to the common use of 'Double-Reels.' Nothing is further from the truth, as the stand taken by the General Office in this matter is one of absolute and emphatic disapproval.

"The most recent development in this direction is the attempt on the part of the Academy of Motion Picture Arts and Sciences to introduce a new projection reel standard of 2,000-foot reels, twice the length of the present standard. The seemingly harmless aspect of this endeavor, coupled with the support and endorsement accorded it by the Motion Picture Producers and Distributors of America, is highly significant in its simplicity.

"Our Local Organizations should become keenly alive to the underlying motive of this move—CUTTING IN HALF THE WORK REQUIRED WITH A SUBSEQUENT CORRESPONDING DECREASE IN MAN-POWER—and forcibly protest against the use of other than single reels, as well as exerting every influence and pressure to definitely discourage the use of other than the present standard size reels."

This pronouncement by the I. A. follows closely the action of the Third (New England) District in recording its unanimous disapproval of the longer reel. No mention is made by the I. A. of any effective means to give force to its opposition, other than the request that local Unions "forcibly protest" and exert every "influence and pressure" to block the introduction of the proposed standard. This recommendation parallels the situation prevailing during the past five years when this and other technical questions were left for local determination and preference.

No Definite Procedure Outlined

Close observers of the situation opined that, with the double reel looming as a certainty during the past five years, similar action by the Alliance may have served to block any consideration of a larger reel standard. As the matter now stands, all preliminary work on the new standard has been done; the unanimous agreement of producers and distributors has been obtained; final specifications for the longer reel have been promulgated; manufacturers have begun to produce the new reel, and the date for adherence to the new standard by the entire industry has been fixed as April 1 next.

What effect, if any, this eleventh-hour official stand by the I. A. will have on plans to introduce the longer reel could not be ascertained prior to publication of this issue. Neither was it learned whether the General Office of the I. A. had formally acquainted the Academy with its views on the double reel, which action, of course, would lend unity to the drive against the double reel and render unnecessary any concern on the part of Locals as to procedure in "forcibly protesting" and "definitely discouraging" the introduction of the proposed standard.

It is considered unlikely in informed quarters that the mere expression of disapproval, in itself and lacking prompt specific action, would serve to head off the introduction of the double reel.

Other *Bulletin* items are of interest. Announcement was made of the regular mid-winter meeting of the I. A. General Executive Board on January 15 at the Fleetwood Hotel, Miami Beach, Fla., coinciding as to time and place with the meeting of the Executive Council of the A. F. of L.

The necessity for placing a man with all 16 mm. shows was against stressed. Asserting that certain companies have been disseminating propaganda that the I. A. did not require the placing of a man with 16 mm. equipment, the *Bulletin* cites I. A.'s ruling that all such equipments be manned by members.

The same conditions apply with equal force to all attractions carrying public address sets of whatever character or number.

NOVEL GUARD MINIMIZES MIRROR PITTING AND BREAKAGE

By E. H. WITT

MEMBER, I. A. LOCAL UNION 160, CLEVELAND, OHIO

EXCESSIVE mirror pitting and the cracking of reflectors are recognized by all projectionists as very troublesome characteristics of the new Suprex arc. The pages of INTERNATIONAL PROJECTIONIST have been a veritable storehouse of data on this new type arc, but there has not yet appeared in print a description of practical means of eliminating these highly undesirable operating results. The last issue of I. P. (for November) carried an article by Edward M. Crocker which probably came closer to the kernel of this twin-headed Suprex problem than have any other data published.

The writer has handled a Suprex arc[1] for more than six months. Excessive pitting was observed right from the start, and various means were employed in an effort to either eliminate or, at least, minimize the effects of pitting. The problem did not become "acute" (that is, from the manager's economic point of view) until two mirrors were cracked in quick succession. This put a dollars-and-cents aspect on the matter, and the projection crew was spurred to greater effort to establish the cause—and, if possible, eliminate the result—of excessive pitting.

The situation is not without its humorous aspects. The mirrors were represented by the supply man as being "heat-proof" and "guaranteed" to be unbreakable. One of the new mirrors cracked the following day, and the other within a week of its purchase—to the tune of $20 each, of course. The dealer promptly protected himself by writing a letter to the manager and blaming a draft from a window, and urged that the projection crew be made aware of his, the dealer's, "findings."

The Pitting Process

Our Suprex lamp is equipped with a sand tray which is filled with fine sand, the theory being that this tray will take care of the molten metal that drops from both carbons. Like all theories, this one called for considerable revising in the light of actual practice. This sand tray is effective only for a few moments; thereafter the metal particles that drop into it cool and harden sufficiently to provide a regular springboard for ensuing particles.

Under these circumstances, ensuing carbon metal peelings—which are in white-hot lava form about the size of a pea—burst into a regular shower of small bits which are precipitated at projectile speed upon the *lower* part of the reflector. It was found, strangely enough, that the very small particles the size of a pinhead caused the most trouble: seemingly, the smaller the particle the greater the velocity. If these minute particles strike the mirror on the *very edge*, they invariably crack it.

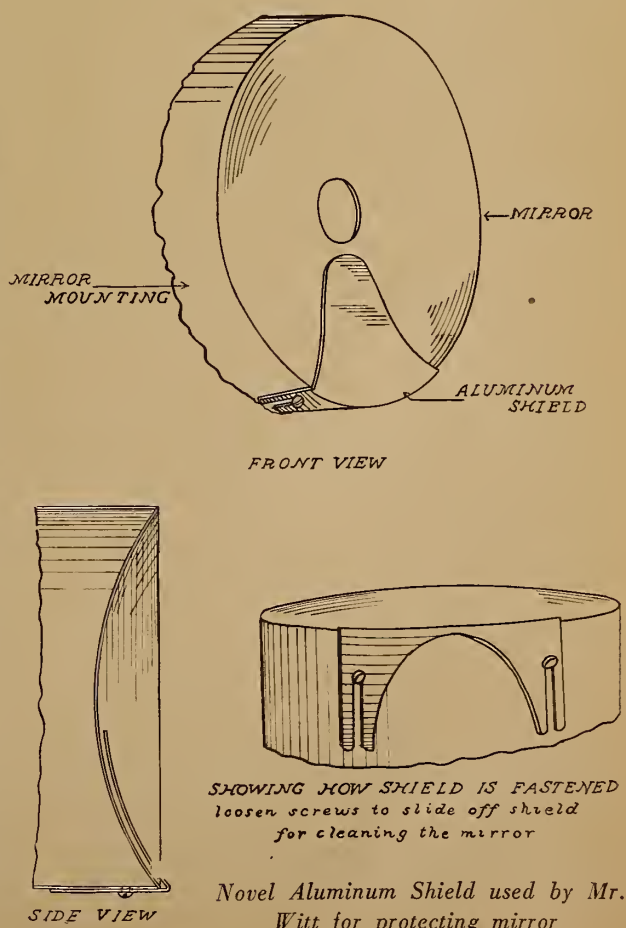
Unless this lava is removed from the tray every ten minutes, at the outside, so as to make a soft bed for the ensuing particles, the use of a sand tray as protection against breakage and pitting is wholly impractical, quite apart from the fact that a sand tray inside a lamphouse is a messy affair in general.

In our particular projection room, provision was made to let the lava fall right through the lamp and table into a receptacle approximately ten inches below the bottom edge of the mirror. Even this did not eliminate the trouble, however, because the positive carbon and guide being U-shaped and unfinished on the inside, cause hot lava to lodge *there;* and new drops, acting like bouncing balls, hit the mirror surface from *that* spot. Pitting continues in the same manner as previously, with the particles being deflected only enough to occasion mirror-striking on the upper side.

Obviously, some other means had to be employed to overcome this problem. Through a process of elimination it became evident that a guard or shield had to be used to protect that part of the reflector *most* exposed to the fiery attack of pits. Every projectionist will immediately shy at mention of a guard or shield, so unsatisfactory have been the results obtained with shields to date, and so necessary is it that primary consideration be given to the vitally important question of light loss. Mirror breakage and the effects of pitting must be eliminated without light loss.

Aluminum Mirror Shield

I think that I have solved this problem. The accompanying sketch is self-explanatory. A highly-polished aluminum shield (see drawing) is fastened to the mirror in the manner indicated. Thus far I have equipped only one of our two lamps with such a shield, and tests have disclosed no light loss as between the machine using the shield and



Novel Aluminum Shield used by Mr. Witt for protecting mirror

[1] In this case, the Magnarc.

Glass Port Light Loss

SHEDDING more light on the perennial question of how much less light is obtained through the use of projector port glass, and supplementing the data on this topic which appeared in the last issue of I. P., is the appended communication from Fish-Schurman Corp., dealers in glass products:

"Whenever the question of enclosing a projection porthole with a glass plate comes up, we are asked how much light is lost thereby. Various factors make for loss of light, namely, the surface of the glass plate, the quality, or, rather, the homogeneity, of the glass itself, and the position in which it is mounted.

"The two surfaces of the plate cause a loss of light of about 4% on each surface, or 8% together, provided the glass is optically plane and perfectly ground and polished with parallel surfaces. With a poor polish the loss is considerably larger.

"The loss of light due to the quality of the glass likewise varies considerably, depending upon the type of glass used. With a homogeneous optical crown glass of a natural white color (which is produced by utilizing the purest raw materials and not by the addition of decolorizing agents) the loss of light due to the glass itself is less than ½ of 1%. On the other hand, with an ordinary glass of a greenish tint, not made by the optical process, the loss of light is considerably greater.

Quality Is Determining Factor

"In other words, everything depends upon the quality of the glass plates themselves. The total loss of light caused by the use of FSC Optical Plane Parallel Porthole Plates is less than 9%. We consider this loss negligible compared with the advantages it offers in preventing disturbing noises from reaching the auditorium, as well as from the viewpoint of fire protection and panic prevention."

---

the machine which is not so equipped.

This arrangement has been in use now for more than two months and has proved satisfactory in every respect. The addition of such a shield on the other machine is due to the lack of interest on the part of the dealer who, although informed of the change made and invited to inspect the job, has failed to visit our theatre and has steadfastly adhered to his original opinion that pitting is caused by drafts. Just how any draft can occasion mirror pitting is a matter on which we defer to the superior knowledge of this supply dealer.

There is no intent here to convey the impression that this little arrangement is the "last word" on the topic or that the question of mirror breakage and pitting is forever settled. Not at all. It is a makeshift until such time as somebody supplies the field with reflectors (whether glass or metal) that will successfully overcome the ill results of Suprex arc peculiarities. Meanwhile, this little arrangement will help to prevent undue pitting and mirror breakage, thereby saving money and annoyance and helping to improve projection.

The accompanying sketch being considered to be self-explanatory, no detailed description of the arrangement need be given here.

Excessive pitting of mirrors when striking the arc can be overcome by first closing the carbons, and then *simultaneously* throwing the switch and opening the carbons. If this operation is carried out properly—both the positive and negative carbons having soft cores—there should be no sputtering at the arc and, consequently, no excessive pitting.

There will be those who will assert that this procedure will injure the commutator on the arc-control motor, which in my particular case happens to be shunt-wound. The only answer I make to this is that in more than twenty years of experience I have yet to see a commutator on such a small motor burn in the infinitesimal span of time required to strike the arc as aforementioned. This same method of starting has been in use for years and is especially beneficial with series motors, which otherwise would develop terrific speed when running without load.

[EDITOR'S NOTE: Mr. Witt is eminently correct in stating that by far the greater proportion of pitting is confined to the lower area of the mirror. The use of a sand pit, as cited by Mr. Witt, has been hailed by some lamp manufacturers as the "cure" for all pitting troubles, which, of course, it most emphatically is not. The carbon pits are white-hot metal particles, some of which are driven against the mirror with projectile speed.

There are many projectionists who are opposed to the interposition of anything before the mirror on the ground that a light loss is inevitable. Theoretically, this contention is sound; yet these objectors should remember that so great is the light loss in the projection chain from arc to screen, the broad question applying here is the *degree* of loss occasioned through use of an appliance such as Mr. Witt's. Surely, such a device must be productive of more acceptable results than a glass shield the curve of which may be decidedly at variance with that of the mirror which the shield is intended to protect.

I. P. reiterates at this time its belief that the solution of this problem of mirror pitting and breakage, admittedly a serious drawback to the progress of the Suprex type arc, will be found in a metal mirror which is not susceptible to pitting, to ordinary breakage or to heat.

Overall, Mr. Witt's article is a fine example of the great value of contributions from the field which detail the requisites of practical projection work.]

Erpi Court Setback

Sometime ago Vocafilm sued Erpi for $65,000,000 on basis of alleged restraint of trade. Erpi countered with charge of patent infringement by Vocafilm, which had no funds to explore this angle. Federal Judge Knox (N. Y.) ruled that since Erpi introduced patent angle in case, it must pay Vocafilm $10,000 expense money to defend such charges. Time passed and no payment was made. Asserting that Erpi was trying to turn proceeding into a vast patent infringement action and also trying to avoid payment of $10,000 to Vocafilm, Judge Knox ruled recently that Erpi must pay costs or drop patent infringement defense.

Rather involved overall, but encouraging news to the field at large.

Distributed to newspapers by a national syndicate, this cartoon indicates the deep impression made upon public consciousness by "operator" picketing. Question: how come the building was excavated?

ERPI REPORTED READY TO ADOPT RCA ROTARY STABILIZER

ERPI will begin soon to convert all of its theatre sound system installations for use of the Rotary Stabilizer, according to reliable information reaching I. P. Efforts to confirm these reports through Erpi proved unavailing. This unit was developed and pioneered by RCA for its Photophone equipments as long ago as 1932 as the only effective means of insuring uniform velocity of the film past the sound scanning point.

Progressive engineering opinion regards the Rotary Stabilizer as absolutely essential for good reproduction of the extended frequency range recordings now coming through from the studios. Improved recordings, of course, mean nothing if a theatre reproducing system, because of either or both electrical and mechanical shortcomings, is unable to transmit the higher quality. No film recording—irrespective of whether it attains or exceeds 10,000 cycles—is any better than the reproducing system and can not possibly deliver more than is permitted by reproducer limitations.

Elaborate mechanical filters between the motor and the feed sprocket and various types of direct drive have been used, all of which were designed to produce uniform rotational velocity of the feed sprocket; but, with few exceptions, no effort has been made to eliminate the annoying ripple necessarily present in sound reproduction from film that is fed only by a sprocket past the sound scanning point.

Technical Aspects of Stabilizer

The time-honored expedient for uniform rotation is a fixed flywheel. However, fixed flywheel control of the drum speed is unsatisfactory, because the flywheel continually hunts or oscillates with the springy film loop in the same manner that a weight suspended from a coil spring will oscillate under the slightest disturbance. It might be suggested that sufficient friction drag be applied to the drum shaft to prevent or damp the oscillations; but when this is done, the film is immediately stretched taut between the feed sprocket and the drum, and the valuable film loop is lost.

It was therefore necessary to develop a rotational speed control for the drum that would not oscillate with the springy film loop nor pull the loop taut so as to destroy it. The devise that was developed to fulfill the requirements is called a "rotary stabilizer."

A number of years ago C. R. Hanna discovered that two rotating masses or flywheels coaxially mounted upon one spring-driven shaft would be critically damped or, in other words, would not oscillate with the driving spring if the assembly were constructed under certain conditions. These conditions were that the inertias of the two flywheels should be approximately in the ratio of 8 to 1, that the small flywheel be rigidly fastened to the shaft, that the large flywheel be free-floating upon the shaft and driven only through a perfectly viscous connection, and that the spring elasticity and the viscous connection have a certain relation to each other and to the flywheels.

This theory leads to a device for controlling the drum speed which exactly meets the two conditions, first, that it does not oscillate with the elastic film loop, and, second, that it does not pull the loop taut.

The rotary stabilizer was designed, according to the theory, as follows: The light flywheel was constructed as a short cylindrical casing made of the lightest possible alloy and firmly fastened to the drum shaft, and the free-floating heavy flywheel was carried inside the casing upon a ball bearing mounted upon its hub. The viscous driving connection to the heavy flywheel is a light oil which completely fills the casing and surrounds the flywheel, and the spring drive to the assembly is the elastic film loop from the sprocket to the drum. The casing is, of course, hermetically sealed by a cover which retains the oil and excludes dirt from the assembly.

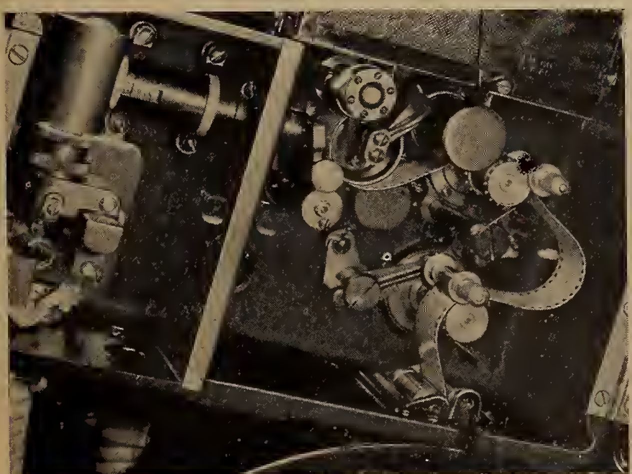
Excellent Results Obtained

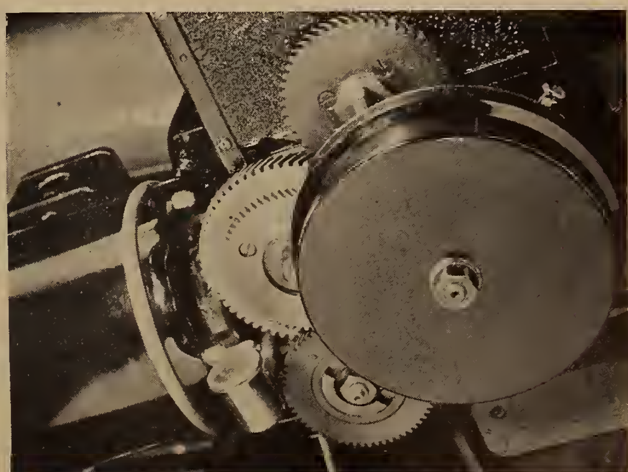
The results attained with the device constructed as outlined were in accordance with the theoretical predictions, and the passage of a film splice or a severe manual disturbance of the film loop does not result in a single complete oscillation of the drum and rotary stabilizer.

It is interesting to note that the theoretical proportions of the rotary stabilizer demand a construction that is at variance with earlier empirical designs of similar damping devices. In these devices the flywheel fastened to the shaft is very large in proportion to the free-floating damping flywheel, and the rotary stabilizer reverses this ratio with greatly improved results. The lack of oscillation between the stabilizer and the film loop is due to the fact that the energy of the disturbance passes from the film loop to the casing and is dissipated in the oil film between the casing and the flywheel. The proportional inertias of the casing and the flywheel are such that the small amount of energy stored in the light casing is insufficient to affect the rotation of the flywheel seriously.

Over a period of years and in a large number of installations the rotary stabilizer has proved to be an extremely satisfactory, accurate, and trouble-free method of controlling film speed.

The recent Lily Pons release, "I Dream Too Much," is credited in informed quarters with having swung Erpi to a final decision in favor of the Rotary Stabilizer. True, the theatre reproduction of the voices of Grace Moore and Jeanette MacDonald was accomplished without undue trouble; but it is gen-





(1) *Rotary Stabilizer, viewed from operating side of soundhead;* (2) *View from driving side of soundhead.*

erally agreed that the coloratura voice of Miss Pons is quite different from the soprano voices of the aforementioned artists. Miss Pons' voice is not only more showy and brilliant, but it includes more of the higher frequencies; and it has been definitely established that the Pons voice may be reproduced satisfactorily only by uniform velocity of film past the scanning light. This is made possible, it is pointed out, only by the Rotary Stabilizer.

Bearing on this point, it is significant to note the reliable report that Erpi has utilized portions of the Pons' recording as a test reel to insure the highest possible accuracy of the old-type sound gates—in advance of the Pons' film booking. Even this unusual expenditure of effort is not regarded as assuring entirely satisfactory reproduction of high-frequency recording such as this picture.

The commercial implications of this situation are quite plain, of course, the probable adoption by Erpi of the Rotary Stabilizer constituting the most emphatic endorsement possible of RCA's progressive engineering work.—J. J. FINN.

Novel 'Speaking Paper' Is Demonstrated in London

"Speaking paper," an invention of an Argentine engineer, was recently demonstrated in London, England, according to a report from the U. S. Department of Commerce. By means of this paper, it is possible to present a record of speech, music or any other sound in as handy a form as the daily newspaper. It is claimed that the invention will create a new industry, which will produce "speaking" books, sell the equivalent of 12-inch graphophone records and will also permit newspapers to print an actual record of a public speech, concert or play which readers could reproduce in their own homes.

How Recorded, Reproduced

The system, called the Fotoliptofono, works more or less on the principals of a sound picture. A sound track is registered on a celluloid negative by means of a microphone and oscillograph. From this photographic impression a block is made from which is printed the "speaking paper," a series of close parallels of jagged black lines, it was stated.

The paper is then placed in the reproducing apparatus. A piece of paper about the size of a single newspaper sheet was fitted on to the cylinder of a machine, and a photo-electric cell retranslated the black lines into impulses which issued from an ordinary portable wireless set as speech, song and music in turn, says the report.

'FILM CURB' NOW A WEEKLY

Tom Hamlin's FILM CURB changes back to weekly again as it enters its thirteenth year January 4, 1936, at Radio City, Rockefeller Center, New York.

Projections

By FRANK DUDIAK

NOTICE seen on the inside lid of a film can: "For rotten projection call the I. A. T. S. E." Well, for greater reading value of this column, we pass along the following: "When a banana is taken away from its bunch it usually gets skinned." The same applies to some people, only they yell during the skinning process.

For keen eyesight, this corner votes for the projectionist. Those S. R. P. black dots appear on the screen only 1/6th of a second. That's less time than it requires to snap the fingers. Speed, ay what?

A few years ago economy was the industry slogan. The Suprex arc was one of the results. However, in our humble opinion we cannot accept the notion that it is more economical. Instead it has resulted in a greater demand for higher screen illumination, and this in turn occasioned an upward trend of the screen illuminating cost or projector light flux (if you prefer that term). The motion picture industry is analogous to the automobile industry in that the nearer it approaches technical perfection, the greater the operating cost.

We take it upon ourselves to estimate that 15% of the projectionists have had some sort of college training, 35% high school training, and 50% an elementary education. This accounts for the assortment of individual responses to a particular situation, due to the great difference in training. Also, the attitude toward and interest in their work will vary greatly between the groups mentioned.

The greater the knowledge of a projectionist the greater the interest in his work. These alert projectionists of today will undoubtedly become the sound service men of tomorrow. It can be done, unquestionably, but only through diligent study on the part of those projectionists who are capable of absorbing the knowledge necessary for efficient sound servicing.

It seems to me that if and when exchanges send 2,000-foot film reels to theatres, there will be plenty of yelling in some localities where the local laws prohibit the projection of double reels. It also comes to us that the I. A. office will assist locals in the enforcement of their local laws with regard to the doubling of reels. Whatever the outcome we for one do not favor the proposed double reel standard, not because the number of change-overs is fewer and the work lightened, but primarily because of the additional fire hazard.

This happens to be quite contrary to the opinions held by many that a double reel is no greater fire hazard than a single reel. Anyhow, it is our firm belief that with the double-reel standard there will be an increase in the percentages of fatalities occasioned by film fires. It impresses us that it is much more sensible to do more work and be in less danger than to do less work and be in greater danger.

[*Ed.'s Note*: I. P. disagrees with Mr. Dudiak on this item. Why the low percentage of fires during the past five years when more than 85% of the country was doubling? No facts in support of Mr. Dudiak's opinion have been forthcoming from any informed quarter. I. P. is definitely not in sympathy with the scare-all bugaboo of fire. It has long since outlived its usefulness.]

I. A. Convention Reported Set For Cleveland

Cleveland has been tentatively selected as the scene of the next I. A. Convention, according to unconfirmed reports. First indications were that Milwaukee would play host to the gathering, but sentiment is reported to have shifted strongly in favor of the Forest City. No definite date set yet, but forecast is for early in June.

Union 'Legitimacy' Cited By New York Court

New York City has three projectionist unions—Local 306, Empire State, and Allied, all claiming to be bona fide, although the latter is under a cloud as being a company union supported and financed by exhibitors. Each union pickets the others' theatres with signs stating that the house does not employ "union labor." This situation is productive of many lawsuits, the basis of which is the "legitimacy" of the various organizations.

These decisions are of interest to projectionists generally throughout the country, as witness the appended decision, in part, of the N Y. Supreme Court in a case where Empire sought to dislodge Allied men from a theatre:

"The injunction heretofore granted in this case has been affirmed by the Appellate Division. Unless the record of the trial discloses some basis for a conclusion other than that reached by the Appellate Division, it is obvious that the determination of the Appellate Court is the law of this case and conclusive upon this court.

"Here the employer employs legitimate and recognized labor union members. A rival labor union, also legitimate and recognized, is aggrieved and wishes to have its members substituted for those of the other union. In order to accomplish its end it has pickets parading in front of the

employer's theatres with signs which read as follows: 'An appeal—do not patronize this theatre; it doesn't employ members of the Empire State Theatrical Stage Employes Union, Inc.'

Statement True; Implication False

"These signs are accurate so far as the letter of truth is concerned, but the implication therefore is untruthful. They represent, and are intended to represent to passersby, that the employer refuses to employ union help. The intent so to represent is obvious. The patrons of a theatre who are in sympathy with the principles of labor unionism are interested primarily in whether or not the theatre employs members of a legitimate labor union and not in whether or not one union has been preferred over another.

"It is to these patrons that the defendant addresses its appeal. To the reader of these signs the impression is given that union labor is not employed. The temporary injunction now in force prohibits the signs unless there are added thereto words in substance as follows: 'Edjomac Amusement Corp. employs union labor to operate motion picture machines.' The temporary injunction is therefore made permanent substantially in its present form."

EVERYDAY SCIENCE

New Sound Camera Sorts Good and Bad Music

Development of a "sound camera," which within a few seconds automatically makes a picture of the quality of tones and noises within most of the range of human hearing has been announced by Dr. Harry H. Hall, of the Cruft Laboratory of Electric Communication Engineering at Harvard University.

With older methods these scientifically important tone pictures could be made only in several days, but Dr. Hall's new apparatus can make them in less than four seconds. With them scientists can study the sounds of musical instruments and can detect and analyze the minute differences in tone between fine and ordinary instruments. Accurate and detailed records of speech sounds can also be obtained with the new camera.

Complete Graph Obtained

Analysis of a sound by the instrument is made from a picture of the relative loudness of all parts of the sound, including the fundamental pitch, the overtones and incidental sounds such as the scratching of a violin bow. These pictures are in the form of line graphs showing the loudness of each of the component parts of the sound under examination.

All sounds from about 50 to 10,000 cycles can be handled by the instrument, a very satisfactory range in comparison with that of the human ear, from about 20 to 20,000 cycles.

The chief value of the device lies in its amazing speed, for a complete picture of a sound can be obtained in 3.78 seconds. This permits thorough and accurate analysis of tones which remain steady for only a short time, such as those of the human voice. Thus the scientist can obtain all the material he needs for a detailed study of sound quality and acoustics.

Lightning Research Yields Interesting Results

"Lightning never strikes the same place twice" is another saying that definitely has been disproved. Engineers of General Electric's high-voltage engineering laboratory staff at Pittsfield, Mass.—men who toy with 10,000,000-volt artificial lightning generators in the laboratory—have obtained a series of photographs that prove lightning to be more than a single flash of high-voltage electricity between cloud and earth. The photographs were obtained with a special type of camera in which the film is whirled past the lens at a speed in excess of a mile a minute. The result is that there is a time scale along the length of the film, and readings in millionths of a second are possible.

During a severe electrical storm this past summer, the engineers set up and pointed their camera toward that part of the sky where the flashes were particularly prominent, started the electric motor which whirled the film past the lenses, and removed the lens cap. The effort had been particularly successful, for the film revealed photographs of 10 separate strokes to ground, and one of these strokes was a multiple flash of 10 recurrent discharges over the same path.

Study of the series of 10 recurrent discharges showed that, except in the case of the first one, each discharge had a certain type of "leader" stroke traveling from the cloud to the earth. This stroke, relatively weak on the film, was immediately followed by a brilliant, powerful flow of the energy in the other direction—from earth to cloud—over the path already cut by the "leader". Following this bright flash the film showed illumination for approximately 1/2,000th second. Then there was a pause of a matter of a few millionths of a second, whereupon another "leader" discharged from cloud to earth, with another immediate stroke from earth to cloud. In rapid succession there were 10 such discharges, all in general being like the preceding ones. All of them occurred in a small fraction of a second—so rapidly that the human eye or usual camera would be unable to follow them.

Observers frequently notice that strokes of lightning are branched or forked. The film showed that the streamers were confined to the first discharge only; thereafter the flashes followed the main path only.

Computing the Results

Knowing the velocity of the film, the focal length of the camera lens, and the size of the photographic image, and being able to determine the distance away of the stroke—either by calculation from the time between the flash and the thunder, or by happening to know where the bolt struck—the engineers have been able to determine numerous properties of the recorded strokes. They have calculated, for instance, that the "leader" travels at a rate of from 14 to 38 feet per microsecond (1/1,000,000th second), and the main stroke up from the earth at from 73 to 180 feet in that time (light travels approximately 1,000 feet per microsecond). Since the "leader" appears to have slight illumination when compared to the main stroke, the engineers have interpreted it as existing in the form of a dart—not as continuous from cloud to earth.

The device with which the photographs were obtained is known as a Boys camera. It was loaned to G. E. engineers by A. P. Loomis, of Tuxedo Park, N. Y. A small motor drives a rotating drum of 29 inches circumference, to which the strip of film is attached with its emulsion side toward the center.

'Experimental' Television Set for 1936, Says Sarnoff, RCA Head, in Citing Technical Advances of 1935

RCA will bring television out of the laboratory in 1936 for the first comprehensive, experimental field test in America, says David Sarnoff, president, in his year-end summary on behalf of the corporation.

"We are planning ahead, bearing the expense of the test of our laboratory achievements under actual field conditions, so that when television is finally introduced on a commercial basis the public shall not be disappointed," states Sarnoff.

In May of this year Sarnoff announced that RCA had formulated a three-point program for the further development of television. This program called for the establishment of the first modern television transmitting station in the U. S., the manufacturing of a limited number of television sets, and the development of an experimental program service.

Summing up progress of RCA companies for 1935, Sarnoff points out that in the sound motion picture field RCA Photophone introduced a new "push-pull" or double sound track method of recording, which gives a greater range of volume gradations and increased fidelity of reproduction over the entire range of audible sound, from 40 to 10,000 cycles, with virtual elimination of all "background noises." A new optical reduction printer, for the making of high quality, 16-mm sound prints from standard size negatives was made available to film printing laboratories by RCA Photophone.

GREAT SERVICE VICTORY WON BY CINCINNATI

(*Continued from page* 23)

short time have washed away practically every objection. We have straightened out trouble that the electrics still are trying to locate. We believe in the basic idea of our Union participating in service work, we know that our work is good and that our prices are right.

There hasn't been a single assignment to date on which the Local Union service has fallen down. Today the Local to a man is proud of our service; and I might add that all the members have benefitted to the extent that our service plan has served to emphasize anew the importance of the projectionist, has improved our members' work and given every member a certain pride in the type of work rendered, whether it be projection or sound system service.

To top it all off, we have received recently, with the assistance of our International organization, an increase of $7.50 per man weekly in the larger houses, and $2.50 per man weekly in the smaller houses. We like to think that our all-inclusive service—on projection and sound systems—had more than a little to do with the general improvement in our conditions.

Any other Local Union desiring information as to procedure, equipment necessary or any phase of sound servicing is cordially invited to communicate with Local 327, Cincinnati.

All of this may sound like the triumph of Local Union 327, but it isn't. Like everything else, and particularly with new projects that call for some measure of pioneering, Local 327 is indebted to those whose advice and practical aid helped us over the rough spots and enabled us to round out our servicing plan. Our heartfelt thanks and deep appreciation is due, and is hereby expressed, to the following:

Official Family of the I. A.
Pittsburgh Local 171
Detroit Local 199
Lima Local 349
Cleveland Local 160
Akron Local 364
Toledo Local 228

Also, Local 327 is indebted to the RCA Service Dept., to the exhibitors in Cincinnati who believe in us, and last but by no means least to INTERNATIONAL PROJECTIONIST.

[NOTE: Comment on the foregoing article appears on the editorial page.]

CHICAGO OFFICERS INSTALLED

New officers of Chicago Local 110 (projectionists), installed on Dec. 6, are: Peter Shayne, president; Frank Clifford, business representative; Glenn Sweeney, vice-president; Neal Bishop, secretary-treasurer; on the executive board: Robert Burns, James Fisco, Joe Berinstein, George Karg; as trustees: John Piotrowski, Louis Barbo, and Edward Schultz, chairman; and Sam Klugman, sergeant-at-arms. All terms expire in March, 1937.

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INVENTIVE TRENDS IN MOTION PICTURES

(*Continued from page 17*)

the camera would not be very restful to look at.

Lighting effects, again, may emphasize or disguise solidarity without reference to binocular vision, but this consideration also is one which very properly yields to others of greater artistic importance.

The only process so far proved feasible for true binocular stereoscopy for large audiences is the "anaglyph" process recently revived by Louis Lumiere. This requires a double camera, a trick printer, a special projector superimposing images of complementary colors, and a bespectacled audience. There is no question of any of these complications being got rid of by further research—they are fundamental to the process.

Entertainment Shortcomings

It will be realized at once that for general entertainment purposes they are fatal.* The double camera would necessarily be noisy and interfere with sound recording unless heavily blimped; color is ruled out, as the final effect is necessarily a black-and-white one, and it is doubtful if audiences would take gladly to the spectacle idea, even if, which is very doubtful, the viewing proves to involve no extra eye-strain.

The "anaglyph" process is therefore scientifically correct but commercially impracticable.

At the other end of the scale, since they are simple but not scientific, are the so-called "subjective" processes which assume that if you put left-eye

* Readers will recall same opinion in "Three-Dimensional Movies Re-Invented by Lumiére," in I. P. for April, 1935, p. 11.—Ed.

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images and right-eye images on the screen simultaneously, each eye will obligingly sort out its own image and a "pseudo-stereoscopic" effect will result. Some experiments have even thrown in a third central image for the benefit of the rudimentary "pineal" eye which anatomists assure us exists in the centre of our brain.

But as I am not writing under a pseudonym, and the pseudo-stereoscopists are always with us, I cannot express myself freely on this subject. I will content myself with predicting that whatever revolutions may be impending, it is not from this direction they will come.

It is not, however, only scientific innovators who bring about the necessity for small inventions. The artistic and literary innovator may bring about a similar state of affairs by demanding from the producer new and intricate special effects. In fact, I get the impression that it is in this department of production that small inventions are most numerous at the moment.

A Peek Into The Future

For example, the preparations made by London Film Productions for Wells' "Shape of Things to Come" involve several specially-designed bits of apparatus of considerable ingenuity and great intricacy. I recently saw the projection-printer which is being built at Worton Hall Studios (England) and was very much impressed by its range of performance and refinements of detail. In order to ensure absolute steadiness of current it draws its supply from its own generator.

Moreover, the scale on which background projection is to be used far exceeds anything yet attempted in this country (England). The two projectors to be employed have claw movements similar to those of a Bell-Howell camera, and stands which, though set on trolley-wheels, have great mass and stability. They will be lighted by means of 250-ampere arcs, and in one scene they will be set side by side, each lighting a 36-foot wide screen, the joint, of course, being masked by some appropriate scenic structure. For the screens a special material has been evolved with the collaboration of the British Celanese Company.

The scale of these preparations gives one an illuminating glimpse into "The Shape of Things to Come" in the world of motion pictures.

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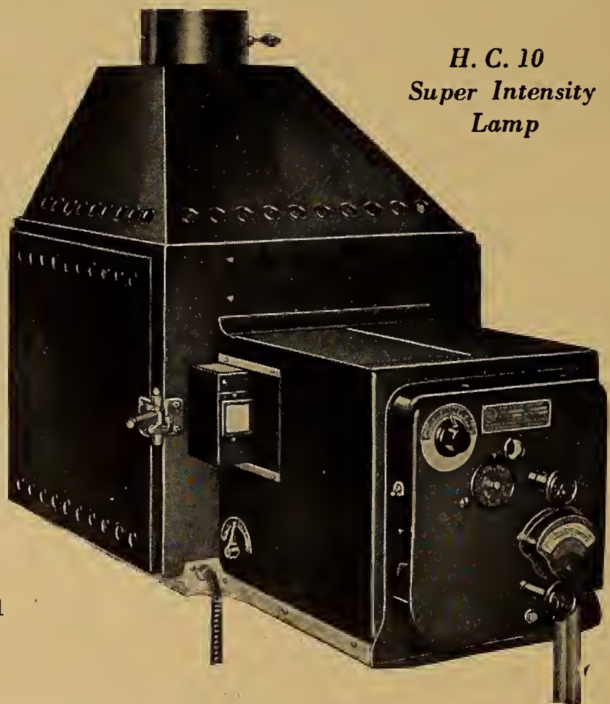

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I. P. OPPOSES SECRECY ON EQUIPMENT DATA

(*Continued from page* 17)

Mfg. Co. (without charge) the appended letter on the face of which were spread a few pertinent facts relative to theatre operation *plus* a renewal of the original request for information. Witness:

Operadio Manufacturing Co.
St. Charles, Illinois.
Att.: Mr. L. B. King, Sales Manager

Gentlemen: Your letter of November 19 misinterprets our recent request for information. Our letter contained no threats, but was a simple statement of fact. Neither do we attempt to act as a "policeman" for this industry, as you imply, how-

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ever desirable the existence of such a person might be in view of the policies pursued by some manufacturers. We are concerned about rendering service to our readers, the fellows who are responsible for the successful operation of the stuff you manufacturers sell to them.

Granted that both our companies have their problems, just what bearing has this on the topic? You cite your unwillingness to distribute information (schematics) "promiscuously," and you cite the vast sums of money expended by you on "engineering." We think that RCA and Erpi each expended at least as much money as your company did on "engineering," yet they display absolutely no hesitancy in not only supplying schematics of every unit of their equipments to users, but they gladly service this publication with prints so that we may publish them for not only an individual but for the entire craft to see.

Just what is there about the Operadio equipment that is so unique, so advanced in either design or construction, so involved and—although we reluctantly voice the thought—so complicated that distinguishes it from either an RCA or an Erpi, or any other good equipment used in the theatre field? This "secrecy" policy is suggestive to us of something to hide. Both RCA and Erpi early adopted the same policy in this field, but they quickly abandoned it in favor of the view that projectionists, the users of their equipments, could not possibly know too much about the design, construction and operation of a sound equipment.

Periodic Inspections Necessary

Were you selling only home radios, your policy of "secrecy," while unintelligent and wholly indefensible, as we see it, might not have the same serious implications as in the present case. But you are not. You happen to be selling equipment in show business, to theatres, whose very existence depends upon an uninterrupted show. What is the extent of your service force? And can your service man get to a theatre within three minutes of a breakdown? If not, then he might just as well stay away, because a wait of three minutes in show business, whether or not you know it, not only ruins a particular performance but also damages permanently (we mean *permanently*) the prestige of a theatre. Are you aware of the fact, readily ad-

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Editor, INTERNATIONAL PROJECTIONIST
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mitted by both RCA and Erpi, each with more than 4000 installations in the U. S., that 98% of a successful servicing set-up lies in constant periodic inspections—*made before trouble develops?*

How is it possible for a projectionist to make periodic inspections of your equipments unless he has a schematic thereof? To your suggestion that the Operadio amplifier is something unique, may we observe that a good modern sound system today is no more complicated than a good radio set. At least, we trust that this opinion also embraces your equipment.

You state that anybody desiring one of your schematics need only purchase one of your equipments in order to obtain one. This is just fine; but in reply to the pure logic of your statement may we observe that our recent request for a schematic was prompted by a request from a projectionist in a theatre which *had* purchased one of your amplifiers! Quoting from the letter by this particular projectionist:

"The only diagram that was sent with the equipment was for the control panel that connected the amplifiers and the external wiring . . . . I wrote twice to Operadio, and they referred my letters back to Southwestern Equipment Company, from whom the amplifier was purchased. The latter said that the only schematic they had was attached firmly in their service manual . . . . Finally, Operadio sent another manual, like that I already had, and showing only the external connections.

"They (Operadio) claim that this is the only diagram they have on the amplifier!"

We ask if the foregoing excerpts are indicative of the fine service rendered by Operadio to those who "merely buy the equipment"?

You also mention the tendency of projectionists to "tinker." Are you aware that strictly projectionist organizations are today servicing more than 1000 theatres in the U. S. and Canada, and are gaining more theatres each week? Further, Operadio having sold the equipment and received the money therefor, isn't it a fact that any unfortunate results stemming from projectionist "tinkering" properly and naturally would be a subject for discussion and settlement between the exhibitor and the projectionist, whose responsibility for any untoward result of "tinkering" is very clearly defined in our mind.

'Authorized' Radio Service Men

Finally, and most important, you mention the fact that you cooperate fully with "authorized radio service men," who do your servicing. Are you aware that such men have no right to enter into, or work in, theatre projection rooms staffed by organization projectionists? Should the International Office learn of this, you may be sure that prompt and vigorous action will ensue.

Because of the aforementioned and other good and sufficient reasons we find it impossible to agree with the contentions set forth in your leter. Thus, we find it necessary to repeat our request of recent date that your company conform to the well-established practice of other sound equipment companies in this field by supplying this office with schematics of all Operadio equipments used in the theatre field.

INTERNATIONAL PROJECTIONIST,
James J. Finn, *Editor.*

Sufficient time having elapsed since the foregoing letter was dispatched to enable Operadio to send not one but 6,497 diagrams as far as Europe, I. P. concludes that Operadio has no intention of complying with such requests. I. P. also reluctantly concludes, therefore, that it is high time Operadio was spotted on the list of disapproved equipment, for all the craft to see. This commission having been executed in practically no time at all, the list of disapproved equipment as it appears in this issue, and positively will appear in all subsequent issues, of I. P. includes both the Cincinnati Time Recorder Co. and the Operadio Manufacturing Co.

This much having been said, there remains only to observe that this little story is intended as notice to manufacturers generally that I. P. intends to adhere strictly to its program of listing under the caption of "Disapproved Equipment" all units the makers of which refuse to cooperate by granting all reasonable requests for data relative to their equipments.

To projectionists goes the message that I. P. will welcome the name of any manufacturer who holds the craft in such contempt that he doesn't think it necessary to favor it with so much as a schematic diagram. We shall see whether the list of Disapproved Equipment or the prestige of the craft is favored with the greatest growth. This writer hazards the guess that they will grow apace.

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